No. 8176

JVC Service Manual

VIDEO CASSETTE RECORDER VHS PAL

HR-7700E

VICTOR COMPANY OF JAPAN, LIMITED.

No. 8176

JVC Service Manual

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MODEL **HR-7700E**

VICTOR COMPANY OF JAPAN, LIMITED

Important Safety Precautions

Prior to shipment from the factory, JVC products are strictly inspected to conform with the recognized product safety and electrical codes of the countries in which they are to be sold. However, in order to maintain such compliance, it is equally important to implement the following precautions when a set is being serviced.

● Precautions during Servicing

1. Locations requiring special caution are denoted by labels and inscriptions on the cabinet, chassis and certain parts of the product. When performing service, be sure to read and comply with these and other cautionary notices appearing in the operation and service manuals.

2. Parts identified by the ⚠ symbol and shaded (▨) parts are critical for safety.
Replace only with specified part numbers.
Note: Parts in this category also include those specified to comply with X-ray emission standards for products using cathode ray tubes and those specified for compliance with various regulations regarding spurious radiation emission.

3. Use specified internal wiring. Note especially:
   1) Wires covered with PVC tubing
   2) Double insulated wires
   3) High voltage leads

4. Use specified insulating materials for hazardours live parts. Note especially:
   1) Insulation Tape
   2) PVC tubing
   3) Spacers
   4) Insulation sheets for transistors

5. When replacing AC primary side components (transformers, power cords, noise blocking capacitors, etc.) wrap ends of wires securely about the terminals before soldering.

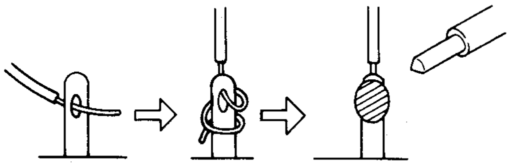

Fig. 1

6. Observe that wires do not contact heat producing parts (heatsinks, oxide metal film resistors, fusible resistors, etc.)

7. Check that replaced wires do not contact sharp edged or pointed parts.

8. When a power cord has been replaced, check that 10—15 kg of force in any direction will not loosent it.

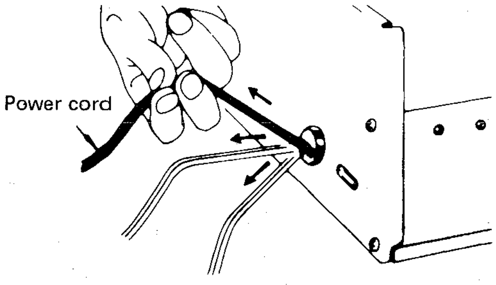

Fig. 2

9. Also check areas surrounding repaired locations.

10. Products using cathode ray tubes (CRTs)
In regard to such products, the cathode ray tubes themselves, the high voltage circuits, and related circuits are specified for compliance with recognized codes pertaining to X-ray emission. Consequently, when servicing these products, replace the cathode ray tubes and other parts with only the parts specified. Under no circumstances attempt to modify these circuits. Unauthorized modification can increase the high voltage value and cause X-ray emission form the cathode ray tube.

11. Crimp type wire connector
In such cases as when replacing the power transformer in sets where the connections between the power cord and power transformer primary lead wires are performed using crimp type connectors, if replacing the connectors is unavoidable, in order to prevent safety hazards, perfomr carefully and precisely according to the following steps.
   1) **Connector part number :** E03830-001
   2) **Required tool :** Connector crimping tool of the proper type which will not damage insulated parts.
   3) **Replacement procedure**
      (1) Remove the old connector by cutting the wires at a point close to the connector.
      Important : Do not reuse a connector (discard it).

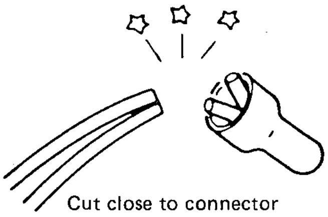

Fig. 3

      (2) Strip about 15 mm of the insulation from the ends of the wires. If the wires are stranded, twist the strands to avoid frayed conductors.

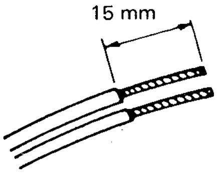

Fig. 4

      (3) Align the lengths of the wires to be connected. Insert the wires fully into the connector.

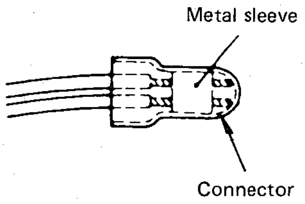

Fig. 5

(4) As shown in Fig. 6, use the crimping tool to crimp the metal sleeve at the center position. Be sure to crimp fully to the complete closure of the tool.

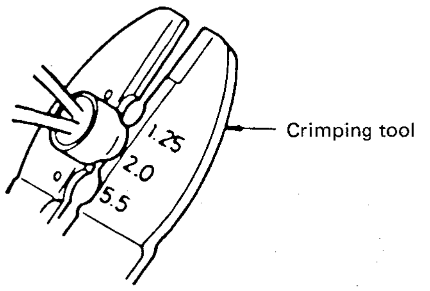

Fig. 6

(5) Check the four points noted in Fig. 7.

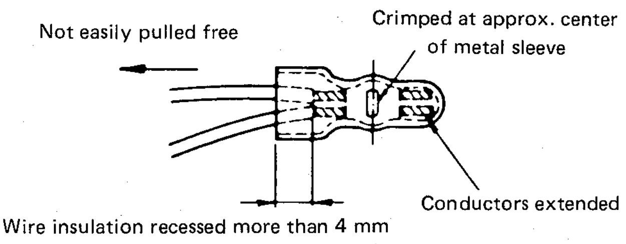
Not easily pulled free
Crimped at approx. center of metal sleeve
Conductors extended
Wire insulation recessed more than 4 mm

Fig. 7

● Safety Check after Servicing

Examine the area surrounding the repaired location for damage or deterioration. Observe that screws, parts and wires have been returned to original positions, Afterwards, performe the following tests and confirm the specified values in order to verify compliance with safety standards.

1. **Insulation resistance test**
   Confirm the specified insulation resistance or greater between power cord plug prongs and externally exposed parts of the set (RF terminals, antenna terminals, video and audio input and output terminals, microphone jacks, earphone jacks, etc.). See table below.
2. **Dielectric strength test**
   Confirm specified dielectric strength or greater between power cord plug prongs and exposed accessible parts of the set (RF terminals, antenna terminals, video and audio input and output terminals, microphone jacks, earphone jacks, etc.). See tabel below.
3. **Clearance distance**
   When replacing primary circuit components, confirm specified clearance distance (d), (d') between soldered terminals, and between terminals and surrounding metallic parts. See table below.

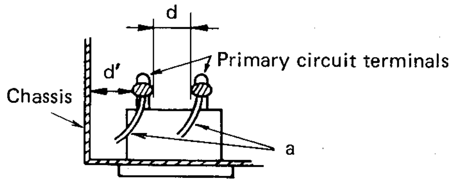

Fig. 8

4. **Leakage current test**
   Confirm specified or lower leakage current between B (earth ground, power cord plug prongs) and externally exposed accessible parts (RF terminals, antenna terminals, video and audio input and output terminals, microphone jacks, earphone jacks, etc.).

   Measuring Method: (Power ON)
   Insert load Z between B (earth ground, power cord plug prongs) and exposed accessible parts. Use an AC voltmeter to measure across both terminals of load Z. See figure and following table.

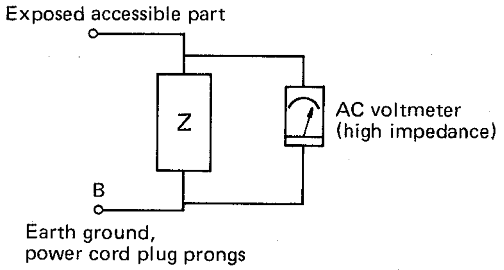

Fig. 9

AC Line Voltage	Region	Insulation Resistance	Dielectric Strength	Clearance Distance (d), (d')
100 V	Japan	≧ 1 mΩ/500 V DC	1 kV 1 minute	≧ 3 mm
110 to 130 V	USA & Canada	–	900 V 1 minute	≧ 3.2 mm
*110 to 130 V 200 to 240 V	Europe Australia	≧ 10 mΩ/500 V DC	4 kV 1 minute	≧ 6 mm (d) ≧ 8 mm (d') (a: Power cord)

*Class II model only.

Table 1 Ratings for selected areas

AC Line Voltage	Region	Load Z	Leakage Current (i)	Earth Ground (b) to:
100 V	Japan	1 kΩ	i ≦ 1 mA rms	Exposed accessible parts
110 to 130 V	USA & Canada	0.15 µF 1.5 kΩ	i ≦ 0.5 mA rms	Exposed accessible parts
110 to 130 V 220 to 240 V	Europe Australia	2 kΩ	i ≦ 0.7 mA peak i ≦ 2 mA dc	Antenna earth terminals
		50 kΩ	i ≦ 0.7 mA peak i ≦ 2 mA dc	Other terminals

Table 2 Leakage current ratings for selected areas

Note: This table is unofficial and for reference only. Be sure to confirm the precise values for your particular country and locality.

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SECTION 1
GENERAL DESCRIPTION

1.1 INTRODUCTION

This manual provides service information for the JVC VHS models HR-7700E. The manual describes the principles and adjustments of mechanical electrical operations for this model. Service procedures given herein cover only field maintenance service. Adjustments which require highlevel instruments, jigs and techniques are excluded, since they should be performed at the factory.

Due to design modifications the servicing procedures and data given in this manual are subject to possible change without prior notice.

VHS
PAL

Only cassettes marked VHS can be used with this video cassette recorder.

WARNING (FOR HR-7700EK)

1. This set is for exclusive use with the PAL colour system (system B and G).
2. SECAM (system B and G) colour programmes might be recorded in certain areas but there is no interchangeability of these recorded cassette tapes with other PAL-VHS recorders or SECAM-VHS recorders.
3. Please use the exclusive SECAM-VHS recorder in SECAM broadcasting areas.
4. Please use only PAL prerecorded cassette tapes or PAL signals which have been recorded with the PAL-VHS system.
5. For camera recording, connect a video camera built to the PAL standard.

IMPORTANT (In the United Kingdom)
Mains Supply (AC 240 V∿, 50 Hz only)

IMPORTANT

Do not make any connection to the Larger Terminal coded E or Green. The wires in the mains lead are coloured in accordance with following code:

Blue to N(Neutral) or Black
Brown to L (Live) or Red

If these colours do not correspond with the terminal identifications of your plug, connect as follows:
Blue wire to terminal coded N (Neutral) or coloured Black. Brown wire to terminal coded L (Live) or coloured Red.

If in doubt — consult a competent electrician.

Note: We recommend that you should disconnect the AC cord from the outlet.

1.2 WARNING

WARNING:
TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS UNIT TO RAIN OR MOISTURE.

CAUTION

Dangerous voltage inside. Refer internal servicing to qualified service personnel. To prevent electric shock or fire hazard, remove the power cord from the AC outlet prior to connecting or disconnecting any signal lead or aerial, prior to replacing the fuse, and prior to altering the voltage setting.

POWER SYSTEM

Connection to the mains supply

The operating voltage of this set is preset to 220 V ∿ at the factory.
Before connecting to mains, check that the voltage selector on the rear panel is set to the same voltage as your local mains supply.

Adapting to local power line

This set operates on either 110, 127, 220 or 240 V∿.
If the preset voltage is different from the power line voltage in your area, reset the voltage selector by inserting a screwdriver into the slot of the voltage selector and turning it until the correct voltage is displayed.

POWER SWITCH

The mains switch is located on the rear connector panel. Setting this switch to OFF removes all applied power from the set including the timer clock. Switching on or off the recorder section is performed with the secondary power switch on the front panel, which consists of three buttons labelled "TIMER", "ON" and "OFF" (referred to as "sub-power buttons").

IMPORTANT: It is permissible to record television programmes only in the event that third party copyrights and other rights are not violated.

1.3 FEATURES

- Motorized front-loading cassette system.
- Full remote control via infrared-ray transmission.
- Pushbutton (feather-light touch) operation due to microprocessor-based, fully electronic logic control system.
- Shuttle search function for quick location at 10 times normal speed in both forward and reverse directions of the programme segment one wishes to view.
- Variable-speed playback in double-speed, slow-motion, freeze-frame and frame-advance modes.
- Fluorescent tube display for indicating tape counting, tape remaining length, clock time, programmed timer recording data and tuner sweep.
- Newly-developed 2-week/8-programme programmable timer.
- Clock/timer memory hold system with a built-in rechargeable battery having a back-up time of about one hour.
- The Automatic Editing Control system which operates on the principle of back-space editing minimizes picture distortion between separately recorded segments.
- Full front operation (frontal location of the cassette loading slot, the main control panel and the compartmentalized sub-panel).
- Newly-developed brushless, quartz-locked direct-drive drum motor plus motors for capstan, reel, cassette loading and tape loading provide greater stability and higher reliability.
- Simplified mechanism and improved performance in addition to stable tape transport and easy alignment via five-motor system.
- Voltage synthesizer tuning system with 32-channel storage capacity.
- Automatic/manual tuning capability.
- Built-in wide-band tuner gives more flexibility in TV programme selection.
- Built-in Dolby* noise reduction system for improved sound quality.
- Advanced mechanisms including cue and counter search for speedy location of a specific programme, triple-function repeat (in Full, Counter and Cue modes) and tape-end automatic rewind.
- Direct camera connection to the front panel connector.
- Improved clock accuracy through use of a quartz oscillator.
- Dimmer control for the entire fluorescent display.

*Dolby is a trademark of Dolby Laboratories Inc.

1.4 SPECIFICATIONS

General	
Power requirement	: 110/127/220/240 V AC, 50/60 Hz
Power consumption	: 55 watts (70 watts with camera)
Camera connector output	: DC 12 V ⎓ 1 A max.
Temperature	: Operating: 5°C to 40°C Storage: -20°C to 60°C
Operating position	: Horizontal only
Weight	: 16.5 kg
Dimensions	: 470(W) x 153(H) x 385(D) mm
Tape deck section	
Format	: VHS PAL standard
Video signal system	: PAL colour and CCIR monochrome signal, 625 lines
Video recording system	: Luminance: FM recording Colour: Phase shift & converted subcarrier direct recording
Scanning system	: Rotary, slant azimuth, two-head helical scan system
Tape width	: 12.7 mm
Tape speed	: 23.39 mm/sec
Playing time	: 180 minutes with E-180
Rewind time	: Within 4 minutes, with E-180
Fast Forward time	: Within 4 minutes, with E-180
Video input	: 0.5 to 2.0 Vp-p/75 ohms
Video Output	: 1.0 Vp-p 75 ohms
Video S/N	: 43 dB (with Rohde & Schwarz noise meter)
Resolution of picture	: More than 250 lines
Audio mic input	: -67 dBs/High impedance unbalanced
Audio line input	: -20 dBs/50 k ohms unbalanced
Audio line output	: 0 dBs/Less than 1 k ohm unbalanced
Audio frequency response	: 70 Hz to 10 kHz
Audio S/N	: 50 dB (noise reduction ON)
TV tuner/RF section	
Channel storage capacity	: 32 channels
Aerial input(EG)	: VHF band I, 47 – 89 MHz VHF band III, 104 – 300 MHz UHF band IV/V, 470 – 862 MHz
Aerial input (EK)	: **UHF band 1 V/V, 21 – 69 CH**
Aerial output	: UHF channels 32 – 40 (Adjustable)
Digital clock/timer	
Clock display	: 24-hour fluorescent digital display with day indication
Reference frequency	: Quartz controlled
Start time setting	: Within 2 weeks
Programming capacity	: 8 programmes
Remote control unit	
Battery	: 6 V (R6 x 4)
Temperature	
Operating	: 5°C to 40°C
Storage	: -20°C to 60°C
Accessories	: AC power cord Aerial cable Video cassette Remote control unit Battery (R6 x 4)

Design and specifications subject to change without notice.

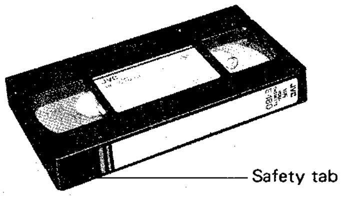
1.5 PRECAUTIONS

Handling and storage

- Avoid using the HR-7700E under the following conditions:
  - extremely hot, cold or humid places,
  - dusty places,
  - near appliances generating strong magnetic fields,
  - places subject to vibrations, and
  - poorly ventilated places.
- Be careful of moisture condensation.
  Avoid using the HR-7700E immediately after moving from a cold place to a warm place or soon after heating a room which was cold. The water vapor in warm air will condense on the still-cold video head drum and tape guides and may cause damage to the tape and the recorder.
- Handle the HR-7700E carefully.
  - Do not block the ventilation openings.
  - Do not place anything heavy on the recorder.
  - Do not place anything which might spill and cause trouble on the top cover of the recorder.
  - Use in horizontal (flat) position only.
- In case of transportation,
  - Avoid violent shocks to the recorder during packing and transportation.
  - Before packing, be sure to remove the cassette from the recorder.

Moisture condensation

- If you pour a cold liquid into a glass, water vapor in the air will condense on the surface of the glass. This is called moisture condensation.
- Moisture condensation on the head drum, one of the most crucial parts of the HR-7700E, will cause damage to the tape.
- Moisture in the air will condense on the HR-7700E when you move the unit from a cold place to a warm place, after heating a cold room or under extreme humidity conditions.
- The HR-7700E is equipped with a moisture condensation prevention circuit which automatically heats the head drum according to the ambient temperature. This circuit operates only when the unit is plugged into an AC outlet, the rear panel POWER switch is set to ON and the front panel sub-power OFF button is pressed in.
- The moisture condensation prevention circuit consumes only a slight amount of power. However, if for some reason you are not using the HR-7700E for a long period of time, it is advisable to remove the power cord from the AC outlet or set the rear panel POWER switch to OFF.
- Since the moisture condensation prevention circuit cannot evaporate existing moisture condensation immediately after the power cord has been plugged into the AC outlet, you must allow for about 2 hours if the HR-7700E is to be used in such areas as would occasion moisture condensation.



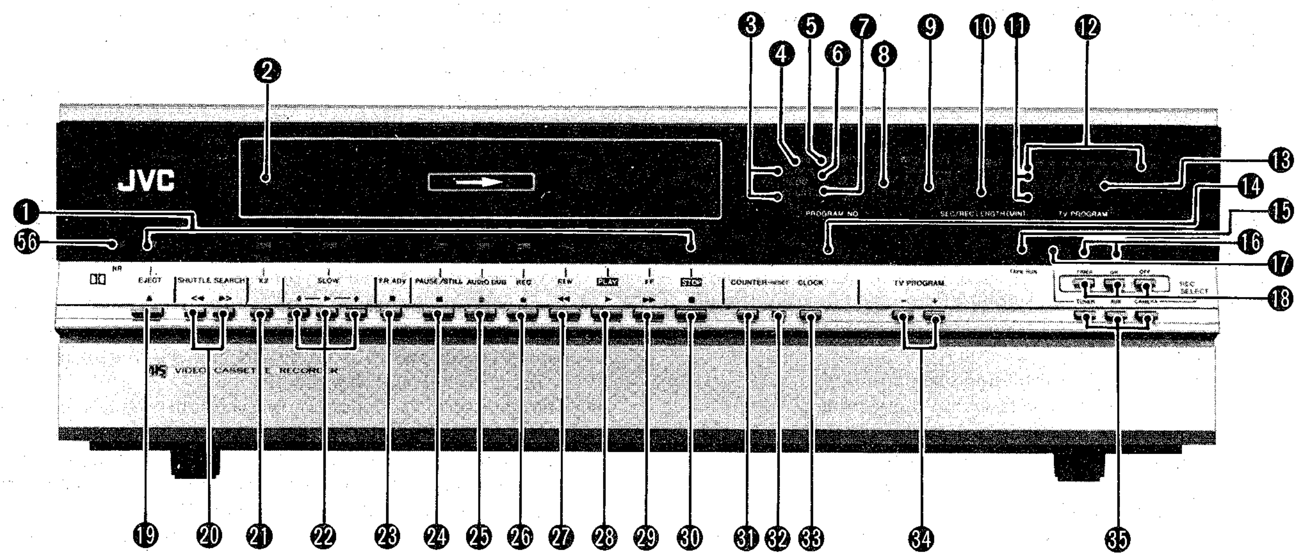
Video cassettes

- The HR-7700E employs VHS type cassettes only.
  E-180 for 3 hours, E-120 for 2 hours, E-60 for 1 hour and E-30 for 30 minutes of recording.
- Video cassettes are equipped with a safety tab to prevent accidental erasure. When the tab is removed, recording cannot be performed. If you wish to record on a cassette whose tab has already been removed, use adhesive tape to block the hole.
- Avoid exposing the cassettes to direct sunlight. Keep them away from heaters.
- Avoid extreme humidity, violent vibrations or shocks, strong magnetic fields (near a motor, transformer or magnet) and dusty places.
- Place the cassettes in cassette cases and position vertically.

Operation

- The cassette can be loaded only when the recorder is powered (with the front panel sub-power ON button pressed in). Do not force the cassette into the slot with the power off.
- When the rear panel POWER switch is set to ON after it has been set to OFF once, the recorder section cannot be powered even though the front panel sub-power ON button has been engaged. In such a case, first press the sub-power OFF button and then press the sub-power ON button once again.
- If you wish to operate the recorder locally after you have switched the power off via the remote control unit, first press the sub-power OFF button and then press the sub-power ON button once again.
- As long as the sub-power ON button is pressed in, switching the recorder on or off can be performed via the remote control unit.

1.6 GENERAL DESCRIPTION OF CONTROLS, INDICATORS AND CONNECTORS



Front main panel

① Tape operation mode indicators
These LEDs light when the relevant operation mode is selected, indicating that the selected mode has been engaged.

② Cassette loading slot
With the sub-power ON button ⑱ pressed, insert a video cassette with its labelled edge facing toward you. The cassette carriage itself will automatically take control and retract the cassette into the correct loaded position.

③ Display mode indicator
The word "CLOCK", "PROG" or "COUNT" will be illuminated depending on the selected display mode: "CLOCK" for either Clock mode or Clock Setting mode, "PROG" for Programmable Timer Setting mode and "COUNT" for Tape Counter mode.

④ Week indicator
The indication "1st" or "2nd" will be illuminated for setting the date for making pre-programmed recordings; "1st" stands for the period within one week and "2nd" within the second week from setting.

⑤ Day indicator
Both for constant day indication and day presetting for future recordings.

⑥ Programme repeat indicator
When a certain scheduled programme is to be recorded repeatedly week after week or everyday indefinitely, the PROG REPEAT button ㊷ is to be depressed. Then this indicator lights to indicate that the command for "repeat" has been memorized.

⑦ PROGRAM NO. indicator
Numerals 1 through 8 are successively displayed to show which programme is ready for entry. Programmes can be called up by pressing the PROG NO. button ㊸ in the Programmable Timer Setting mode either for entry or for checking.

⑧ Hour digits

⑨ Minute digits

⑩ SEC/REC LENGTH (MIN) digits
A two-digit figure is displayed for counting the seconds in the Clock mode or Clock Setting mode. On the other hand, in the Programme Setting mode, three digits are displayed and a recording length can be set in minutes (settings in 5-minute increments up to 395).

⑪ TV programme display mode indicator
The indication "CH SET", "PROG" or "LOCK" will be illuminated, depending on the selected mode of the TV PROGRAM indicator ⑬. When the CH SET MODE button ㊼ is depressed for pretuning the built-in tuner, "CH SET" is illuminated and the TV PROGRAM indicator ⑬ shows the channel number of the TV programme to be memorized. When the PROG SET button ㊶ is depressed for presetting the programmable timer, "PROG" is illuminated and the TV PROGRAM indicator ⑬ shows the channel number of the TV programme to be recorded in the future. When the CH LOCK button (52) is depressed, "LOCK" is illuminated, showing the displayed channel number of the TV programme cannot be altered.

⑫ Tuner sweep/Tape-remaining-length indicator
This series of 10 segments has two different functions; a tuner sweep indicator which shows the tuner's station scanning process (see page 1-11) and a tape-remaining-length indicator in the record and play modes (see page 1-26).

⑬ TV PROGRAM indicator
Numerals 1 through 32 are successively displayed for the selection of a TV programme channel number in different modes (refer to ⑪).

⑭ Remote control indicator
This LED lights when the recorder is operated through the remote control unit. It lights when any control button on the remote control unit is pressed, indicating that the recorder has received a command from the remote control unit.

⑮ TAPE RUN indicator
This LED blinks according to the supply reel speed, in synchronism with the tape counter, showing the condition of tape running. It appears to remain lighted during fast forward and rewind because of its high-speed blinking.

⑯ **Sub-power indicators**
The left LED lights when the TIMER button among the sub-power buttons ⑱ is pressed, indicating that power will be switched on when the preset time is reached. The right LED lights when the ON button is pressed.

⑰ **TUNER indicator**
This LED lights when the TUNER button among the REC SELECT (recording input select) buttons ㉟ is pressed, indicating that the signals being received by the built-in tuner are ready to be recorded.

⑱ **Sub-power buttons (TIMER, ON, OFF)**
Press the ON button when you use the recorder for recording or playback. Press the TIMER button after you have preset the recorder for unattended timer recording. Press the OFF button to switch off the power from the recorder section.

⑲ **EJECT button**
Press to eject the cassette.

⑳ **SHUTTLE SEARCH buttons**
These buttons enable high-speed playback at 10 times normal (video only) in either the reverse direction (left button " <◄ ") or the forward direction (right button " ►> ") only while they are being pressed, facilitating fast and accurate location of a particular section on the tape.

㉑ **X2 button**
Press for double-speed playback after engaging the Play mode.

㉒ **SLOW buttons**
Press the centre button " I► " for slow-motion playback after engaging the Play mode. To vary the slow-motion speed, use either button to the left or right; the left one " ⬇ " for decreasing the speed and the right one " ⬆ " for increasing the speed. When the desired speed is reached, release your finger from the button.

㉓ **Frame advance button (FR ADV)**
To view the playback picture frame by frame. When the button is pressed once after the Still mode has been engaged, the picture is advanced by one frame.

㉔ **PAUSE/STILL button**
To stop the tape temporarily. During recording, press this button to avoid recording unwanted material. During playback, press this button to view a still picture.

㉕ **AUDIO DUB button**
Press together with the PLAY button ㉘ to record audio on a pre-recorded tape.

㉖ **Record button (REC)**
Press together with the PLAY button ㉘ for video and audio recording.

㉗ **Rewind button (REW)**
To rewind the tape. The REW button can be pressed directly from any mode except Record and Audio Dub modes.

㉘ **PLAY button**
To play back the tape. Also press this button together with the REC button ㉖ for recording or with the AUDIO DUB ㉕ button for audio dubbing.

㉙ **Fast forward button (FF)**
To fast forward the tape. The FF button can be pressed directly from any mode except the Record and Audio Dub modes.

㉚ **STOP button**
To stop the tape.

㉛ **COUNTER button**
Press this button when you want to use the fluorescent display as a tape counter. Then the COUNT indicator ③ will be illuminated and the four-digit figure (from 0000 to 9999) will be displayed as the tape runs.

㉜ **Counter RESET button**
To reset the tape counter to "0000".

㉝ **CLOCK button**
Press this button when you want to change the display mode to the Clock mode from any other mode.

㉞ **TV PROGRAM −/+ button**
Press these buttons to call up a channel for pre-tuning or to select preset stations. Pressing the (−) button changes the channel number in the direction of decreasing figures. Pressing the (+) button changes the channel number in the direction of increasing figures. The selected TV programme channel number will be displayed on the TV PROGRAM indicator ⑬.

㉟ **REC SELECT buttons**
For selecting the recording input signal.
TUNER: To record signals coming from the built-in tuner (TV programmes).
AUX: To record signals coming from units connected to the rear panel VIDEO IN and AUDIO connectors.
CAMERA: To record signals coming from a camera connected to the front panel CAMERA connector (camera shots).

Front sub-panel

㊱ **HEADPHONES jack**
Connect a set of headphones for monitoring the sound during audio dubbing or for private listening.

㊲ **MIC jack**
Connect a microphone for audio dubbing or mixed recording.

㊳ **TAPE MEMORY switches**
Automatic repeat of playback, automatic search for the counter reading of "0000" or the cue signal position, etc. are possible with various combinations of settings of these two switches. For details, see pages 1-27 and 1-28.

㊴ **TRACKING controls**
Turn these controls to minimize noise bar, if observed during playback. Use the SLOW/STILL control during slow-motion/still-frame/frame-advance playback and the X2/PLAY control during double-speed/normal-speed playback.

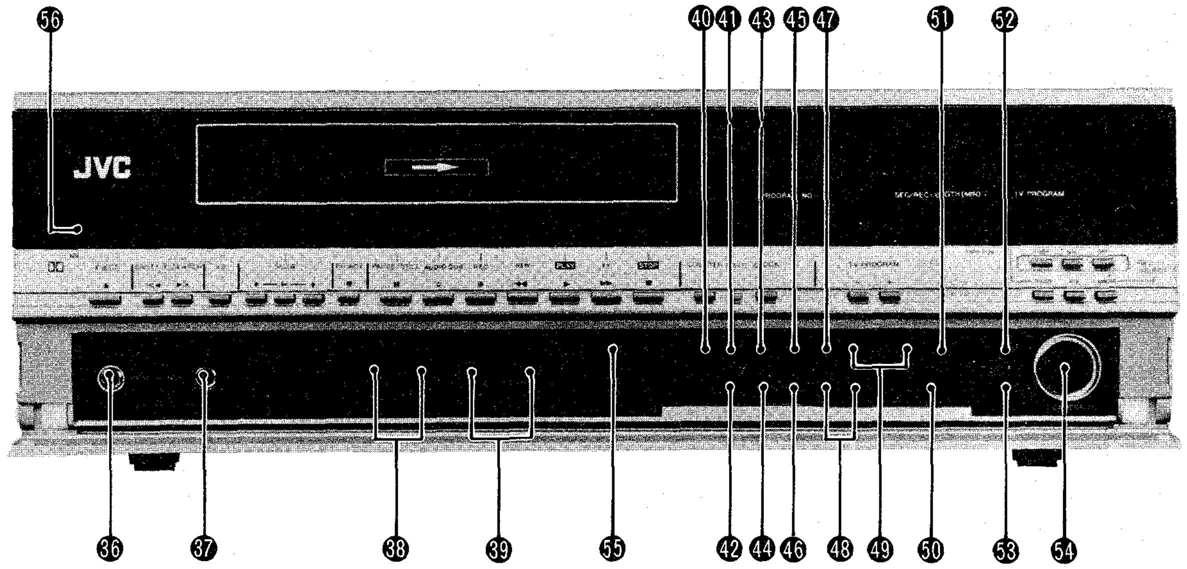
㊵ **CLOCK SET button**
Press this button when you adjust the clock for the correct time and the day of the week. For details see page 1-13.

㊶ **PROG SET button**
Press this button when you pre-programme the timer by entering such data as the day of the week, switch-on time, recording length and the channel number of the TV programme from which you to record.

㊷ **PROG REPEAT button**
After you have entered all programming data for unattended recording, if you wish the entered data to be kept for repeated recording, press this button. The programme repeat indicator ⑥ will be illuminated.

㊸ **PROG NO button**
Press this button in the Programme Setting mode to call up a programme number to which the recording data are to be entered. The number of the called-up programme will be displayed on the PROGRAM NO indicator ⑦.

㊹ **CANCEL button**
Press this button to cancel or "clear" the preset data after calling up the corresponding programme number on the PROGRAM NO indicator ⑦.



㊺ SELECT button
Press this button to call up the specific item for setting. When the PROG SET button ㊶ is pressed (referred to as the Programme Set mode), the item for setting changes each time this button is pressed in the order of "channel", "day", "hour", "minute" and "recording length", and the corresponding portion of the display flashes.
When the CLOCK SET button ㊵ is pressed (referred to as the Clock Set mode), the item for setting changes each time this button is pressed in the order of "second", "minute", "hour" and "day", and the corresponding portion of the display flashes.

㊻ SET button
After selecting the item for setting with the SELECT button ㊺, press this button until the desired indication is reached. Holding it pressed continuously advances the indication rapidly. However, when you select the "second" setting with the SELECT button ㊺, the second indication is held at "00" when the SET button is held pressed. This is to set the clock time precisely to the second.
(See page 1-13.)

㊼ CH SET MODE button
Press this button to pre-tune the built-in tuner to TV stations in your area. (See pages 1-11 and 1-12.)

㊽ FINE TUNING buttons
After you have tuned the built-in tuner to a specific TV station with the BAND tuning buttons ㊾, you can make fine tuning adjustment using these buttons.

㊾ Tuning buttons (BAND I, III, U) (EG only)
Press one of these buttons corresponding to the band of stations you are going to tune to.

BAND I:	For tuning to 47 – 89 MHz
BAND III:	For tuning to 104 – 300 MHz
BAND U:	For tuning to 470 – 862 MHz

The function of the buttons differs depending on the setting of the PROG SEARCH switch (51).

㊿ STORE button
After you have tuned the built-in tuner to a particular station, press this button. Then the station is stored in the memory for the selected channel (displayed on the TV PROGRAM indicator ⑬) so that you can call it up at any time by simply pressing the TV PROGRAM buttons ㉞.

(51) PROG SEARCH switch
This switch selects between manual tuning and automatic tuning.

MANU:	When the PROG SEARCH switch is set to this position, station scanning is performed manually. This means that the tuner sweeps only while the BAND button ㊾ is being pressed. Releasing the BAND button stops the sweeping.
AUTO:	When the PROG SEARCH switch is set to this position, station scanning is performed automatically. This means that sweeping of the tuner is initiated by pressing the BAND button once and it stops automatically when a TV station is captured.

(52) CH LOCK button
Press to ON after you have selected the channel. Then accidentally touching the TV PROGRAM buttons ㉞ will not change the selected channel. Release to OFF by pressing it again when you select a new channel.

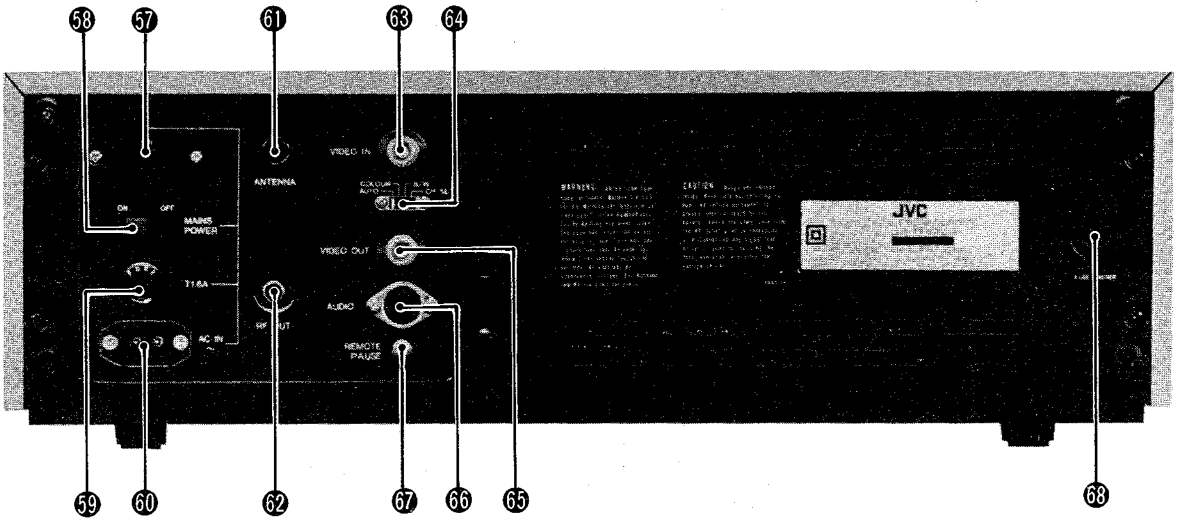
(53) DIMMER button
The brightness of the display can be subdued by pressing this button.
This button functions only when the unit is powered with the sub-power ON button pressed. However, once the desired brightness has been selected with the sub-power ON button pressed, it is maintained during the power-off period or the standby period for timer recording.

(54) CAMERA connector
Connect a JVC video camera directly to this connector using only a 10-pin camera cable.
Caution: Other brands of cameras and some of JVC cameras may not be electronically compatible, even though the same type of connector is used. Please consult your dealer.

(55) Dolby noise reduction button (NR)
To activate the built-in Dolby noise reduction system to eliminate tape hiss noise, press this button to ON. Recordings made with the NR button set to ON should be played back with the NR button set to ON. The sound quality is not improved if non-Dolbyized recordings are played back with the NR button set to ON, but the tone differs from the original.

(56) Dolby indicator
This LED indicator lights when the NR button (55) is pressed to ON.

Rear panel



(57) **Voltage selector**
The preset voltage is indicated in the window. If it differs from your local power line voltage, reset it. See "POWER SYSTEM" on page 1-1.

(58) **POWER switch**
Switching ON applies mains power to the set. To switch off the set completely, set the POWER switch to OFF. This switches off the timer/clock circuit and cancels all the preset programming data after the memory back-up time that is determined by the charge of the built-in rechargeable battery has expired. This also switches off the built-in antenna circuit so that the TV receiver connected to the HR-7700E will not be able to receive off-air TV programmes for good viewing condition. Normally set this POWER switch to ON.

(59) **FUSE holder**

(60) **AC IN socket**
Connect the AC power cord (provided) to this socket.

(61) **ANTENNA connector**
Connect an external antenna to this connector.

(62) **RF OUT connector**
Connect to the antenna connector of a TV receiver through the aerial cable (provided).

(63) **VIDEO IN connector**
Connect the video output of other video equipment such as a video camera (through an appropriate adapter) or another video tape recorder.

(64) **Video mode select switch**
This applies to both recording and playback.

AUTO: The circuit is automatically switched for colour or black/white mode. This position is sufficient for most purposes.
COLOUR: Set to this position when the input or playback video signal is in colour.
B/W: Set to this position when the input or playback video signal is monochrome.
CH SET: Set to this position when tuning your TV receiver for "Video Channel". (See page 1-10.)

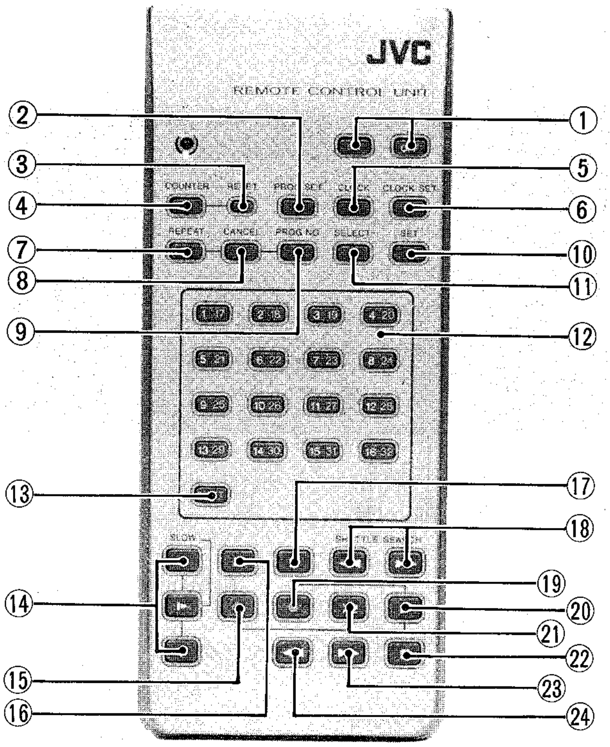
(65) **VIDEO OUT connector**
Video signals being recorded or played back are available from this connector.

(66) **AUDIO input/output DIN socket**
Connect a tape recorder or other audio sources or connect the audio output of a video camera (through an appropriate adapter) or other video sources for recording.
Also, audio signals being recorded or played back are available from the output terminals of this DIN socket.

(67) **REMOTE PAUSE terminal**
When using a JVC video camera connected to the VIDEO IN and AUDIO connector, connect the remote control terminal of the camera adapter to this terminal for the purpose of controlling the starting and stopping of the tape during recording with the camera's start/stop switch.

(68) **Vertical lock adjustment knob (V. LOCK ADJ)**
For adjusting the picture during slow-motion, still-frame and double-speed playback if the TV receiver's V-hold control fails to correct a phenomenon caused by insufficient vertical lock.

Remote Control Unit



① **ON/OFF buttons**
These buttons function in the same way as the ON and OFF buttons ⑱ on the recorder. Only when the rear panel POWER switch is set to ON and the front panel sub-power ON button is pressed in, these two buttons can function to switch the recorder on or off.

② **PROG SET button**
Same as the PRG SET button ㊶ on the recorder.

③ **RESET button**
Same as the RESET button ㉜ on the recorder.

④ **COUNTER button**
Same as the COUNTER button ㉛ on the recorder.

⑤ **CLOCK button**
Same as the CLOCK button ㉝ on the recorder.

⑥ **CLOCK SET button**
Same as the CLOCK SET button ㊵ on the recorder.

⑦ **REPEAT button**
Same as the PROG REPEAT button ㊷ on the recorder.

⑧ **CANCEL button**
Same as the CANCEL button ㊹ on the recorder.

⑨ **PROG NO button**
Same as the PROG NO button ㊸ on the recorder.

⑩ **SET button**
Same as the SET button ㊻ on the recorder.

⑪ **SELECT button**
Same as the SELECT button ㊺ on the recorder.

⑫ **Channel number buttons**
These buttons are used to call up the desired TV programme channel. (On the recorder, the TV PROGRAM –/+ buttons ㉞ perform this same function.)

To call up channel 1, press the "1/17" button. For channel 2, press the "2/18" button. And so on. To call up channels from 17 to 32, first press the button carrying the corresponding number and then press the SHIFT button ⑬.

The channel number will be displayed on the TV PROGRAM indicator ⑬ on the recorder.

⑬ **SHIFT button (EG only)**
If you want to call up a channel between 17 and 32, first press the corresponding channel number button (shared with for channels between 1 and 16) and then press this button. By pressing this button, the selected channel is shifted by 16 channels.

⑭ **SLOW buttons (↑) (ı►) (↓)**
Same as the three SLOW buttons ㉒ on the recorder. For increasing the slow-motion speed, use the upper button " ↑ " and for decreasing, the lower button " ↓ ".

⑮ **Audio dubbing button (≑)**
Same as the AUDIO DUB button ㉕ on the recorder.

⑯ **Pause/Still button (❚❚)**
Same as the PAUSE/STILL button ㉔ on the recorder.

⑰ **Frame advance button (≡)**
Same as the FR ADV button ㉓ on the recorder.

⑱ **SHUTTLE SEARCH buttons (<◄) (►>)**
Same as the two SHUTTLE SEARCH buttons ⑳ on the recorder.

⑲ **Record button (●)**
Same as the REC button ㉖ on the recorder.

⑳ **Play button (►)**
Same as the PLAY button ㉘ on the recorder.

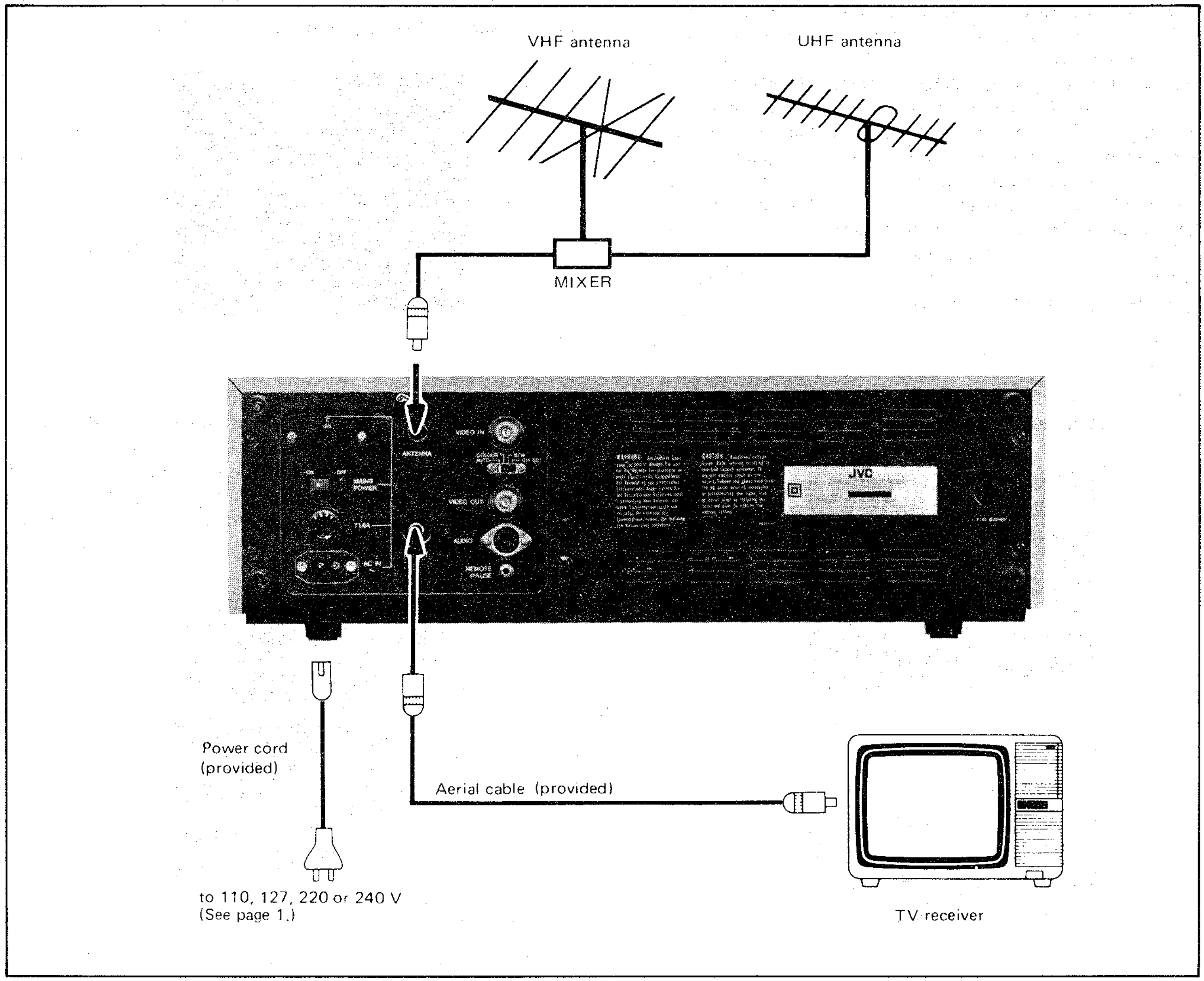
㉑ **X2 button (X2)**
Same as the X2 button ㉑ on the recorder.

㉒ **Stop button (■)**
Same as the STOP button ㉚ on the recorder.

㉓ **Fast forward button (►►)**
Same as the FF button ㉙ on the recorder.

㉔ **Rewind button (◄◄)**
Same as the REW button ㉗ on the recorder.

1.7 HOW TO CONNECT THE HR-7700E TO YOUR TV RECEIVER



Procedure

1. Remove the antenna cable from your TV receiver and reconnect it to the HR-7700E as illustrated. The HR-7700E is then ready to record off-air TV programmes.
2. Connect the HR-7700E to the TV receiver using the aerial cable provided. The TV receiver is then ready to receive TV broadcast programmes as well as video cassette programmes from the HR-7700E.

Note:
Even when you are not using the HR-7700E, the rear panel POWER switch should be set to ON in order to be able to view TV broadcast programmes with this connection.

For reference

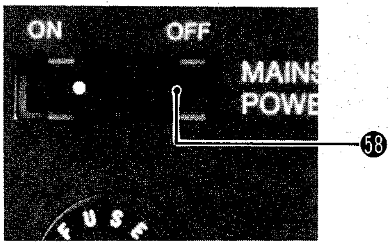
- Previously, when you were using only the TV receiver, broadcast signals went to the TV receiver directly from the antenna.
  Now, after you have connected the HR-7700E to the TV receiver, broadcast signals enter the HR-7700E directly from the antenna (to be received by the built-in tuner for recording onto the cassette tape) and go to the TV receiver through the HR-7700E (to be received by the TV receiver's tuner for ordinary viewing).
- In order to transmit entering broadcast signals to the TV receiver, an antenna circuit is built into the HR-7700E. This antenna circuit must function as long as you are viewing TV programmes even though you are not using the HR-7700E. If the rear panel POWER switch is set to OFF, the HR-7700E's antenna circuit is also switched off. In this state, the connected TV receiver cannot properly receive off-air TV programmes for good viewing condition. Therefore, normally, keep the rear panel POWER switch set to ON.

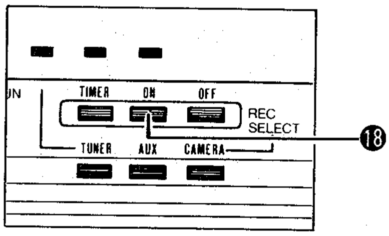
1.8 HOW TO SET YOUR VIDEO CHANNEL

Viewing video cassettes means that the TV receiver receives video playback signals just like it receives broadcast signals. For this purpose, the TV receiver must be set to a specific channel. That channel is "YOUR VIDEO CHANNEL". And it is the built-in RF converter that determines your video channel, since the RF converter permits playback of video and audio recordings through a TV receiver. The signals from the RF converter are viewed through a vacant channel not used for broadcasting. The converter channel of all units is set to UHF channel 36 prior to shipment. Setting your TV receiver to UHF channel 36 may provide video playback. However, to obtain the best possible reproduction on your TV receiver, accurate adjustment to the RF converter output is required.

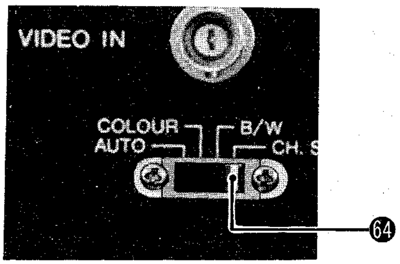
Procedure

1. **Set the rear panel POWER switch (58) to ON and press the subpower ON button ⑱ on the front panel.**

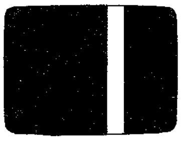




2. **Set the video mode switch (64) , located on the rear panel, to CH SET (Channel Setting).**

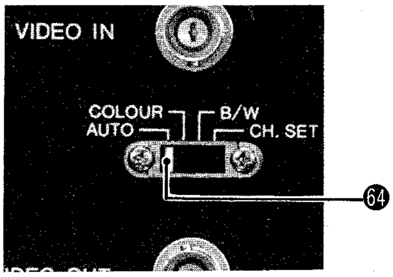


3. **Adjust your TV receiver in the vicinity of UHF channel 36 until you bring in the white signal bar on the screen as illustrated.**



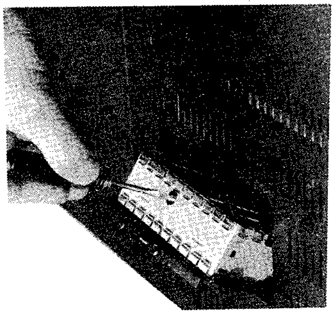
This setting is now the VIDEO CHANNEL of the TV receiver to which the HR-7700E is connected.

4. **Reset the video mode switch (64) to AUTO.**



Notes

- When you adjust your TV receiver to channel 36 for video playback, if some interference noise is seen on the screen because of broadcasts on neighbouring channels or if your preset UHF broadcasts should be affected in picture quality, it is necessary to adjust more accurately the RF converter output.

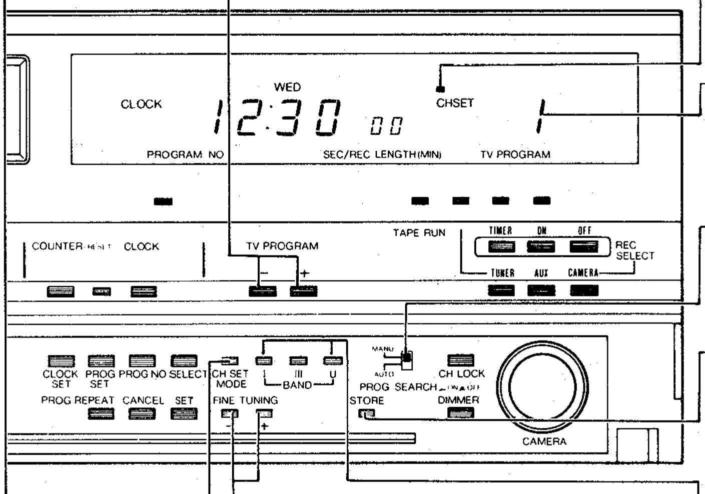


  For this purpose, open the RF converter compartment cover on the bottom of the set and re-adjust the RF converter frequency adjustment screw in minute steps. Then tune the TV receiver once again until a clear picture is obtained.

  This adjustment requires extreme precision and must be done with the utmost care. We recommend that you consult your JVC dealer for making this adjustment.
- Be sure to set the video mode switch to AUTO after VIDEO CHANNEL tuning has been completed.
- No signal is available from the VIDEO OUT terminal while the Channel Setting signal is being used.
- If a prerecorded VHS cassette is available, TV adjustment for VIDEO CHANNEL setting is also possible using it to obtain a playback picture. Insert the cassette and operate the HR-7700E for playing back the cassette (See page 1-14 "How to load and unload the video cassette" and see page 1-17 "How to play back the video cassette".) Then tune the TV receiver to obtain clear pictures and sound while monitoring the playback picture on the TV screen.
- If your TV receiver is not provided with an AFC circuit, perform fine tuning of the TV receiver when you are actually viewing video cassettes.

1.9 HOW TO PRE-TUNE THE BUILT-IN TUNER

Basic guidelines


CLOCK
WED
12:30 00
CHSET
1
PROGRAM NO
SEC/REC LENGTH(MIN)
TV PROGRAM
COUNTER RESET CLOCK
TV PROGRAM
– +
TAPE RUN
TIMER ON OFF
REC SELECT
TUNER AUX CAMERA
CLOCK SET
PROG SET
PROG NO SELECT
PROG REPEAT CANCEL SET
CH SET MODE
I III U
BAND
FINE TUNING
– +
MANU
AUTO
PROG SEARCH
STORE
CH LOCK
DIMMER
CAMERA

㉞ TV PROGRAM buttons
Used to call up the desired TV programme channel number on the TV PROGRAM indicator ⑬.

⑫ Tuner sweep indicator
Shows the station scanning process. This indicator also functions as a tape-remaining-length indicator, however, in this section it is only referred to as the tuner sweep indicator.

⑬ TV PROGRAM indicator
Displays the TV programme channel number which is called up for pre-tuning to a specific TV station.

(51) PROG SEARCH switch
Selects either automatic tuning or manual tuning.

㊿ STORE button
Permits the pre-tuned TV station to be held in memory corresponding to the channel whose number is displayed on the TV PROGRAM indicator ⑬.

㊽ FINE TUNING buttons
Used to obtain the best possible picture.

㊼ CH SET MODE button
Engages or disengages the Channel Set mode.

㊾ BAND buttons
Used to sweep the tuning voltage, either automatically or manually, while selecting the corresponding TV station frequency band.

The built-in tuner of the HR-700E has a capacity of receiving 32 different channels of TV programmes. You can preset any TV programme in your area to any one of these 32 available channels. It is you who determine what TV programme to specify for what channel number.

The basic procedure is: to call up a channel number, tune in to a station and store the information.

Then you easily can call up any preset station simply by pressing the TV PROGRAM buttons.

Procedure

- Open the sub-panel cover and slide the transparent protector so that the tuner setting buttons are made accessible.
- Press the sub-power ON button ⑱, and number "1" will be displayed on the TV PROGRAM indicator ⑬.
- Switch the power of the TV receiver ON.
- Adjust the TV receiver's channel to your VIDEO CHANNEL. (See page 1-10.)
- Press the TUNER button of the REC SELECT buttons ㉟.

Now a TV programme being received by the built-in tuner will be shown on the screen of the TV receiver and you are ready to preset the built-in tuner to TV stations in your area while monitoring the picture on the TV screen.

Note:
The preset memory will last for about one year at 20°C even though power is not applied. If it should happen to be cleared, perform pre-tuning again.

A. Presetting by automatic tuning

1. Press the CH SET MODE button ㊼, and the indication "CH SET" will be illuminated on the TV programme display mode indicator ⑪ and the tuner sweep indicator ⑫ will light at some position.
2. Set the PROG SEARCH switch (51) to AUTO.
3. Press the TV PROGRAM buttons ㉞ to specify the channel for which you are going to preset.
   - Numeral "1" is now displayed. If you preset for channel No. 1, proceed to next step.
   - If you wish to call up another channel, operate the TV PROGRAM buttons.
     "+" button: To increase the TV programme channel number. (-) button: To decrease the TV programme channel number.
   - These buttons can be pressed either repeatedly for changing the number in a single increment or continuously held for rapid automatic changing.
4. Press one of the three BAND buttons ㊾. **(EG only)**
   "I" button: To tune to VHF channels 47 – 89 MHz
   "III" button: To tune to VHF channels 104 – 300 MHz
   "U" button: To tune to UHF channels 470 – 862 MHz
   - Pressing a BAND button initiates automatic scanning with the tuner's voltage sweeping automatically.
   - The tuner sweep indicator will move from the left to the right as the auto-scanning process proceeds.
   - When any broadcast signal is detected, sweeping will automatically stop and the indication will remain at that position.
   - Check to see if the received broadcast is your desired one or not. If so and if the picture quality is not good enough, proceed with fine tuning in the next step.
5. Press the FINE TUNING buttons ㊽, if necessary, to bring in the best possible picture while monitoring on the TV screen.
   - In the Auto-tuning mode, these buttons function to shift the AFC centre frequency; " – " button in the direction of decreasing frequencies and " + " button in the direction of increasing frequencies.
6. Press the STORE button ㊿.
   - This permits the tuned-in station to be memorized so that you can call up the same station at any time by simply pressing the TV PROGRAM buttons to call up the corresponding channel number on the TV PROGRAM indicator.
   - This step completes one cycle of presetting operation.
7. Press the TV PROGRAM buttons ㉞ to change the channel number and repeat steps 4, 5 and 6 to preset all necessary channels.
   - Pressing the same BAND button will restart scanning where the previous scanning stopped.
   - When one cycle of the sweep is completed for the selected band, the tuner sweep indicator will return to the original position and wait for the next band selection.
8. When all the desired TV programmes have been pre-tuned, press the CH SET MODE button ㊼ again to disengage the Channel Set mode.

B. Presetting by manual tuning

Procedures are identical with auto-tuning. However, pay close attention to the following points.

- Set the PROG SEARCH switch (51) to MANU.
- Station scanning takes place only while a BAND button ㊾ is being pressed.
- In the Manual-tuning mode, the FINE TUNING buttons ㊽ function to change the tuning voltage slightly, rather than changing the AFC centre frequency.
- In the Manual-tuning mode, pressing either a BAND button or a FINE TUNING button will switch off the AFC circuit, and releasing them will automatically switch on the AFC circuit after a short pause.

Notes

- With automatic tuning, only those stations which have a signal strength exceeding a certain level can be captured.
- To tune in weaker signals, employ the Manual-tuning mode.
- Be sure to disengage the Channel Set mode by pressing the CH SET MODE button once again after having finished the channel setting procedure, otherwise programming of the timer will be impossible.

Skipping unused TV programme channels

Though 32 channels are available for presetting to desired TV programmes, you may not need all 32 channels. In such cases, unused channels can be skipped so that only preset channels will be called up by pressing the TV PROGRAM buttons ㉞.
For this purpose, proceed as follows:

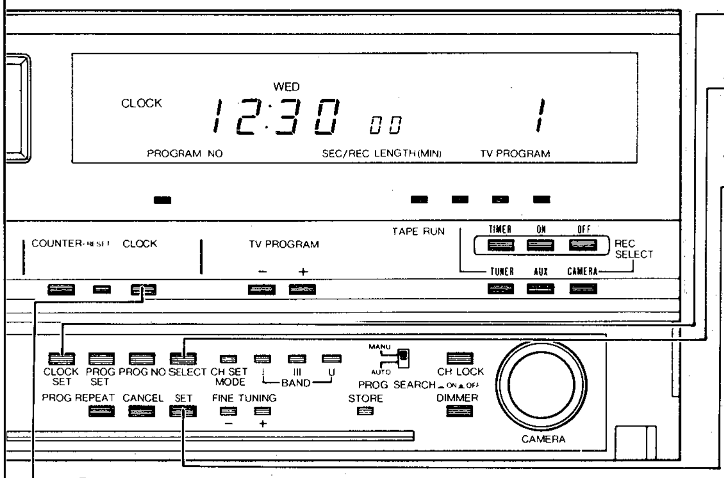
1. Press the CH SET MODE button ㊼.
2. Set the PROG SEARCH switch (51) to MANU.
3. Call up the channel number that you wish to skip by pressing either one of the TV PROGRAM buttons ㉞.
4. Press the STORE button ㊿ and any one of the BAND buttons ㊾ simultaneously.
   - This completes the procedure for skipping the corresponding channel number.
5. Call up another channel number that you wish to skip and repeat the same procedure as above.
6. Press the CH SET MODE button ㊼ to disengage the Channel Set mode.

Notes

- After the Channel Set mode is disengaged, those skipped channel number will not be displayed on the TV PROGRAM indicator any more when the TV PROGRAM buttons are operated.
- In the Channel Set mode, all channel numbers including skipped ones are successively displayed when the TV PROGRAM buttons are pressed.
- It is possible to restore the skipped channels for presetting to another TV programme whenever necessary. For this purpose, call up the corresponding channel number in the Channel Set mode and perform pre-tuning either in the Auto-tuning or Manual-tuning mode. Press the STORE button. Then, the new TV programme channel is memorized and called up at any time with the TV PROGRAM buttons.
- The channel number "1" is an exception.
  It cannot be skipped.

1.10 HOW TO SET THE CLOCK

Basic guidelines



㊵ **CLOCK SET button**
Engages the Clock Set mode.

㊺ **SELECT button**
Selects the item for setting; "second", "minute", "hour" and "day".

㊻ **SET button**
Enters the required data for each selected item.

You need only four controls to set the clock.
First, CLOCK SET and last, CLOCK.
In between, only SELECT and SET.
Select the item (the called-up item will flash to indicate that it is ready to be set) and set it by entering the correct data.

㉝ **CLOCK button**
Engages the Clock mode.

Procedure

When the HR-7700E is plugged into an AC outlet and the rear panel POWER switch is turned ON, the display shows a flashing "SUN 88:88 00" with the word "CLOCK" illuminated. Now you are ready to set the built-in clock to the correct local time.

- Open the sub-panel cover so that the necessary buttons are accessible.
- Slide the transparent protector on the sub-panel so that the timer setting buttons are made accessible. This protector prevents you from accidentally touching the buttons of the other section.
- Press the sub-power ON button ⑱. Setting the clock is possible only when the power is switched on. With the power off, the Clock mode is always engaged.

1. Press the CLOCK SET button ㊵, and the "second" digits will start counting while flashing.
2. Press the SELECT button ㊺, and then the "minute" digits will start flashing.
3. Press the SET button ㊻ until the correct minute indication is displayed.
4. Press the SELECT button ㊺, and then the "hour" digits will start flashing.
5. Press the SET button ㊻ until the correct hour indication is displayed.
6. Press the SELECT button ㊺, and then the "SUN" indication will start flashing.
7. Press the SET button ㊻ until the correct day is displayed.
8. Press the SELECT button ㊺, and then the "second" digits will start flashing.
9. Hold the SET button ㊻ pressed, and the seconds will be reset to and held at "00".
   - If the SEC indication is over "30" (from 30 to 59), pressing the SET button will reset the SEC digits to "00" but will give one increment to the minute indication (for example, 10'35" – 11'00").
10. Release the button at the exact instant of the reference time signal (radio, telephone, TV, etc.) and the clock will be set accurately to the correct local time.
11. Press the CLOCK button ㉝ to return to the Clock mode. No item will be flashing any more.

Notes

- Holding the SET button pressed for more than 1 second continuously advances the minute, hour or day indication automatically. Pressing it once advances the indication in single increments only.
- During the Clock Set mode, if no command is entered within 70 seconds, the Clock mode will be automatically engaged. If you have not yet made the clock setting, press the CLOCK SET button once again to engage the Clock Set mode.
- After having finished setting the clock, if you press the sub-power OFF button, the Clock mode is automatically entered.

Power failure indicator

SUN
CLOCK
88:88 00
1
PROGRAM NO
SEC REC LENGTH MIN
TV PROGRAM

- If you find "SUN 88:88 00" flashing on the display, it means that a power failure has occurred and time-keeping has not taken place since that time.
- Correct the time indication following the above procedures.
- If the period of power outage is within about one hour, correct time-keeping continues when power is reapplied.
- During this one-hour period, the built-in memory back-up battery maintains time-keeping and preset timer memory, though the display blacks out.
- The memory back-up battery is automatically being recharged as long as the rear panel POWER switch is set to ON. It takes about one week to recharge this battery from its fully discharged condition.

Readjusting the clock time

- If a slight increase or reduction of time indication is found, readjust the clock following the same procedure as for time setting.
- Remember that the seconds from 0 to 29 will be reset to "00" when the SET button is pressed and the seconds from 30 to 59 will be reset to "(+1'):00".

1.12 HOW TO RECORD A TV PROGRAMME WHILE WATCHING IT

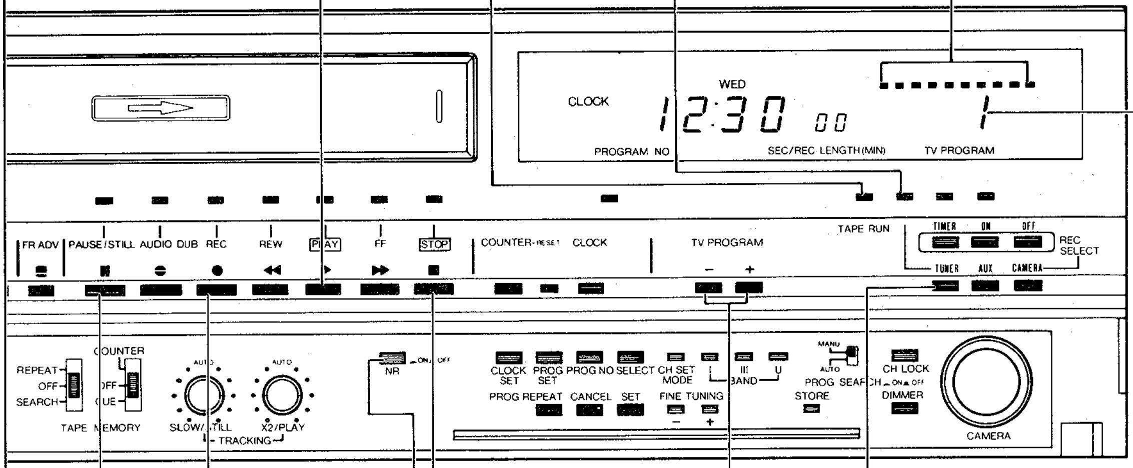
Basic guidelines

⑮ **TAPE RUN indicator**
Flashes to show that the tape is running.

㉘ **PLAY button**
To start tape transport.

⑰ **TUNER indicator**
Lights when the TUNER button is pressed.

⑫ **Tape-remaining-length indicator**
Ten segments of the indicator will turn off one by one as the tape progresses to its end and, during the final about 5 minutes, the last segment will flash continuously. (See page 1-26.)


CLOCK
WED
12:30 00
PROGRAM NO
SEC/REC LENGTH(MIN)
TV PROGRAM
FR ADV
PAUSE/STILL
AUDIO DUB
REC
REW
PLAY
FF
STOP
COUNTER-RESET
CLOCK
TV PROGRAM
− +
TAPE RUN
TIMER
ON
OFF
REC SELECT
TUNER
AUX
CAMERA
REPEAT
OFF
SEARCH
COUNTER
OFF
CUE
TAPE MEMORY
AUTO
SLOW/STILL
X2/PLAY
TRACKING
ON OFF
NR
CLOCK SET
PROG SET
PROG NO SELECT
CH SET MODE
PROG REPEAT
CANCEL
SET
FINE TUNING
− +
III
U
BAND
MANU
AUTO
PROG SEARCH
STORE
CH LOCK
ON OFF
DIMMER
CAMERA

㉖ **REC button**
To start recording.

㉚ **STOP button**
To stop recording.

㉟ **TUNER button**
Activates the built-in tuner.

㉔ **PAUSE/STILL button**
To stop the tape temporarily.

(55) **NR button**
To improve sound quality.

㉞ **TV PROGRAM buttons**
Used to call up the desired channel number.

⑬ **TV PROGRAM indicator**
Displays the channel number of the TV programme that you are going to record.

Now you are ready to record your favourite TV programmes. Guidelines for doing this: receive the desired TV programme with the built-in tuner and operate the tape section.

Preparation

1. Press the sub-power ON button ⑱.
2. Load a cassette.
3. Press the TUNER button ㉟.
   - The TUNER indicator will light.
4. Set the channel selector of your TV receiver to your VIDEO CHANNEL. (See page 1-10.)
5. Press either one of the TV PROGRAM buttons ㉞ to call up the channel number of the TV programme you are going to record.
   - The picture you are going to record will appear on the TV screen, but recording is not yet taking place.

- If a clear picture or correct colour is not obtained, tuning may not have been done accurately. Re-perform tuning in the manner described in "HOW TO PRE-TUNE THE BUILT-IN TUNER" on pages 1-11 and 1-12.
- If the picture is still not clear, perform fine-tuning adjustment on the TV receiver.
- Distorted pictures or sound will be recorded if fine tuning has not been properly performed. Exercise care with this adjustment since the recorded picture and sound cannot be corrected later.

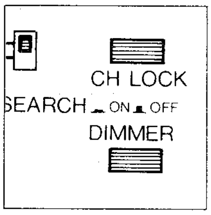
Recording

1. Press the REC and PLAY buttons ㉖ ㉘ simultaneously. Recording will start.
   - When these buttons are pressed, first the tape is pulled out from the cassette and loaded around the tape transport mechanism. During this period, the PLAY indicator will flash.
   - Then recording starts while the tape is running. In this state, both the REC and PLAY indicators remain lighted.
   - About 15 to 20 seconds after the tape has started running , the tape-remaining-length indicator will start functioning. (See page 1-26.)
2. Press the NR button (55) if you wish to make hiss-less recordings.
   - The Dolby indicator will light.
3. To skip recording part of the programme, press the PAUSE/STILL button ㉔ The tape will stop while remaining in the Record mode.
   - The PAUSE/STILL indicator will light with also the REC and PLAY indicators remaining lighted.
4. To release the Pause mode, press the PLAY button ㉘.
5. To stop recording, press the STOP button ㉚.
   - When the STOP button is pressed, first the tape is unloaded from around the tape transport mechanism. During this period, the STOP indicator will flash. When the tape has returned into the cassette, the indicator remains lighted.
   - When the end of the tape is reached during recording, the tape is automatically rewound to the beginning and stops. During rewinding, the REW indicator lights and, when the tape reaches the beginning, the STOP indicator lights.

Notes

- For using the tape counter, see page 1-26.
- If the REC button cannot be pressed, check to see if the the cassette safety tab has been removed. (See page 1-3.)
- Sound from a microphone connected to the MIC jack can be mixed with the TV sound being recorded.
- When the TUNER button is pressed, or when the sub-power ON button is pressed with the TUNER button already pressed in, the TV programme which was received last is always called up.
- The Pause mode is released automatically after 6 minutes in order to prevent tape damage and the Stop mode is engaged.

Channel lock mechanism



- There is a button labelled "CH LOCK" (52) on the sub-control panel. If you press this button in, the channel number cannot be changed by pressing the TV PROGRAM –/+ buttons ㉞ or channel number buttons on the remote control unit.
- This is to prevent the selected channel from being accidentally changed by touching any of those buttons during recording.
- Be sure to press the CH LOCK button again to release it when you select a new channel.

1.13 HOW TO RECORD ONE TV PROGRAMME WHILE WATCHING ANOTHER

A programme, not being viewed, can be recorded while you enjoy viewing another programme. This permits the recorded programme to be played back later at your convenience. The recording procedures are exactly the same as when recording a TV programme while watching it.

The key points to be remembered are:

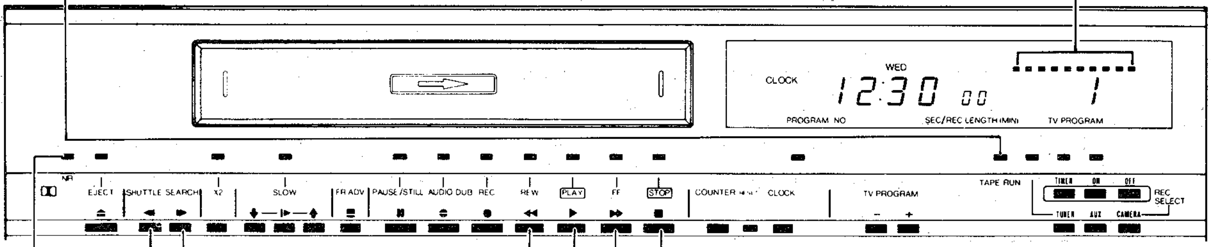
- Select the channel you wish to record with the recorder's channel selector, namely, the TV PROGRAM buttons ㉞.
- Select the channel you wish to view with the TV receiver's channel selector.

1.14 HOW TO PLAY BACK THE VIDEO CASSETTE

Basic guidelines

⑮ **TAPE RUN indicator**
Flashes to show that the tape is running. Its flashing interval is accelerated or decelerated according to the tape supply reel speed.

⑫ **Tape-remaining-length indicator**
Ten segments of the indicator will turn off, one by one, as the tape progresses to its end and, for the final about 5 minutes, the last segment will flash continuously. (See page 1-26.)



㉗ **REW button**
To rewind the tape.

㉘ **PLAY button**
To start playback.

㉙ **FF button**
To fast forward the tape.

㉚ **STOP button**
To stop playback.

⑳ **SHUTTLE SEARCH buttons**
To rapidly transport the tape (at 10 times normal) in either direction to locate the desired tape position.

(56) **Dolby indicator**

This section only describes the basic playback operation. You will find in the next section more enjoyable and convenient facilities that can be used while playing back the tape.

Procedure

1. Press the sub-power ON button ⑱.
2. Load a cassette.
3. Set the channel selector of your TV receiver to your VIDEO CHANNEL. (See page 1-10.)
4. Press the PLAY button ㉘.
5. Make sure that the Dolby indicator (56) lights if you play back tapes recorded with the NR button ON. If it does not light, open the sub-panel cover and press the NR button (55) to ON.
6. To stop playback, press the STOP button ㉚.
   - When the end of the tape is reached during playback, the tape is automatically rewound to the beginning.

Rewinding and fast forwarding the tape

- The REW button ㉗ can be pressed while in the Play mode. When the REW button is pressed while in the Play mode, first the tape is unthreaded from around the tape transport mechanism (with the REW indicator flashing) and then starts rewinding with the indicator remaining lighted. When the beginning of the tape is reached, the Stop mode is automatically engaged.
- The FF button ㉙ can also be pressed while in the Play mode. When the end of the tape is reached, the tape automatically starts rewinding. If you wish to stop it midway, simply press the STOP button ㉚.

Shuttle search function

The unique "shuttle search" function permits you to reach quickly your desired tape section while following the playback picture on the TV screen. The tape speed is 10 times the normal and "search for a scene" is possible in both directions; either forward or reverse. This is why this function is named "shuttle search".

- After engaging the Play mode, press either one of the SHUTTLE SEARCH buttons ⑳ depending on the direction in which you are going to search for a particular scene and hold it until your desired scene appears on the screen. Releasing the button restores the normal Play mode.
- Since the audio circuit is switched off in this mode, you are free from "unintelligible" sound.

Notes

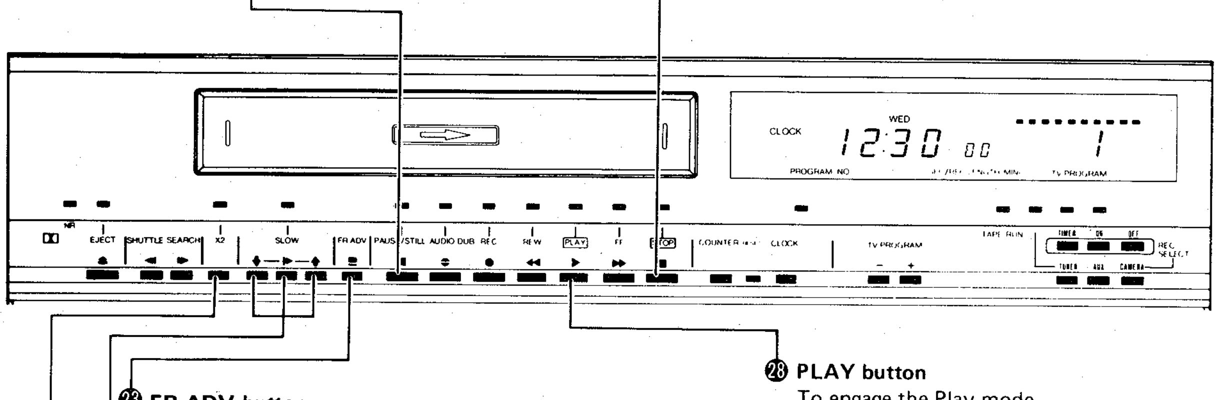
- For usage of the tape counter, and TAPE MEMORY switches, refer to pages 1-26 – 1-28.
- If the playback picture contains noise bars, adjustment with the TRACKING controls may be necessary. Refer to page 1-28.

1.15 HOW TO ENJOY VARIABLE-SPEED PLAYBACK

Basic guidlines

㉔ **PAUSE/STILL button**
To view a still picture.

㉚ **STOP button**
To stop playback.



㉘ **PLAY button**
To engage the Play mode.

㉓ **FR ADV button**
To view still pictures successively by advancing the tape by one frame at a time.

㉒ **SLOW buttons**
To view slow-motion pictures at variable speeds.

㉑ **X2 button**
To watch a programme in half the usual time.

To view still-frame, slow-motion or fast-motion playback, first you have to engage the Play mode by pressing the PLAY button. Then any time you can switch to variable-speed playback by pressing the corresponding button.

Double-speed playback

- After engaging the Play mode by pressing the PLAY button ㉘, press the X2 button ㉑. The X2 indicator will light and playback will take place at a speed twice the normal.
- The sound is also accelerated, but still intelligible.
- To restore the normal playback speed, press the PLAY button ㉘.
- This function will be especially convenient for quickly running through longer tape sections while at the same time following the contents until you reach the actual section you want to view at the normal speed.

Slow-motion playback

- After engaging the Play mode by pressing the PLAY button ㉘, press the centre " I▶ " button of the SLOW buttons ㉒. The SLOW indicator will light and playback will take place at a slower speed.
- You can increase or decrease the slow-motion speed according to your needs. Press and hold the left " ♦ " button to decrease the speed and release it when the desired speed is reached. To increase the speed, press and hold the right " ♦ " button until you get the desired speed.
- The slow-motion speed is variable from approx. 1/4 or 1/5 to 1/25 the normal.
- No audio is heard in the Slow-motion mode.

Still-frame playback

- After engaging the Play mode by pressing the PLAY button ㉘, press the PAUSE/STILL button ㉔. The PAUSE/STILL indicator will light and the picture will "freeze" instantly.
- To release the Still mode, press the PLAY button ㉘.
- The Still mode is released automatically after 6 minutes in order to prevent tape damage and the Stop mode is engaged.

Frame advancing

- While in the Still mode, you can advance the picture frame by frame.
- Pressing the FR ADV button ㉓ once, advances the picture by one frame.
- This function will be convenient to search for the precise instant of a crucial scene you wish to view.

Notes

- If the playback picture is blurred or contains noise bars, make adjustment using the TRACKING controls. (See page 1-28.)
- During still-frame or slow-motion playback, the TV picture might vibrate horizontally. To reduce such vibrations, we recommend that you employ the AV channel for video playback if your TV receiver is provided with such. If the vibrations are rather excessive, consult your local JVC dealer.

1.16 HOW TO PRESET THE TIMER FOR UNATTENDED RECORDING

Basic guidelines

③ **Display mode indicator**
Displays "PROG" in the Programme Set mode.

④ **Week indicator**

⑤ **Day indicator**

⑥ **Programme repeat indicator**

⑦ **PROGRAM NO indicator**
Displays the called-up programme number.

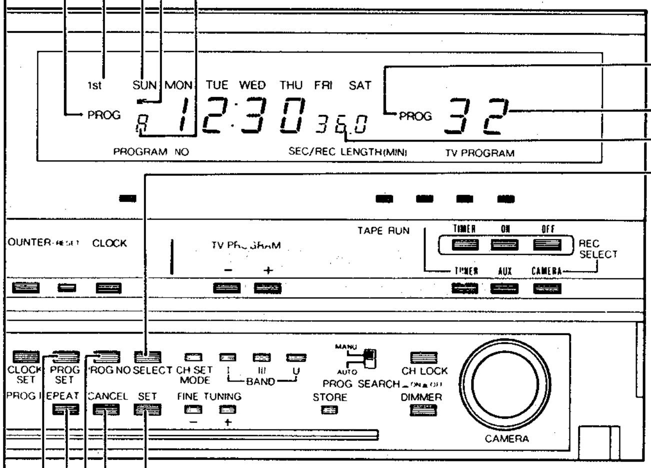
⑪ **TV programme display mode indicator**
Displays "PROG" in the Programme Set mode.

⑬ **TV PROGRAM indicator**
Displays the channel number of the TV programme to be recorded later.

⑩ **SEC/REC LENGTH (MIN) digits**
Displays the recording length in minutes in the Programme Set mode.

㊺ **SELECT button**
Selects the item for setting; "channel", "week", "day", "hour", "minute" and "recording length".

㊻ **SET button**
Sets the required data for each called-up item.


1st
SUN
MON
TUE
WED
THU
FRI
SAT
PROG
1 12:30 360
PROG
32
PROGRAM NO
SEC/REC LENGTH(MIN)
TV PROGRAM
COUNTER RESET
CLOCK
TV PROGRAM
− +
TAPE RUN
TIMER
ON
OFF
REC SELECT
TIMER
AUX
CAMERA
CLOCK SET
PROG SET
PROG NO
SELECT
CH SET
MODE
BAND
MANU
AUTO
PROG SEARCH
CH LOCK
PROG REPEAT
CANCEL
SET
FINE TUNING
STORE
DIMMER
CAMERA

㊹ **CANCEL button**
To cancel the preset data.

㊸ **PROG NO button**
To call up a programme memory on which recording data are to be entered.

㊷ **PROG REPEAT button**
For repeated pre-programmed recording.

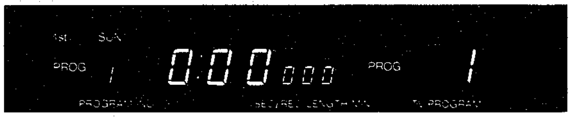
㊶ **PROG SET button**
Engages the Programme Set mode.

The built-in 2-week/8-programme programmable timer permits recording of preset channels on preset days, at preset times for preset lengths while you are away. First preset the programmable timer and then operate the recorder section for unattended recording (this procedure is described in the next chapter). Guidelines for presetting the timer: Call up a programme number among 1 through 8 and enter the programming data with the SELECT and SET buttons.

Procedure

- Open the sub-panel cover and slide the transparent protector so that the programming section is made accessible.
- Press the sub-power ON button ⑱. The Programme Set mode can be engaged only when the power is switched on.

1. Press the PROG SET button ㊶.
   - The display will be changed from the Clock mode to the Programme Set mode.


1st
SUN
PROG
1
0:00
000
PROG
1
PROGRAM NO
SEC/REC LENGTH MIN
TV PROGRAM

- When the PROG SET button is pressed, programme No. 1 is always called up first. If you wish to change the programme number, press the PROG NO button.

2. Press the SET button ㊻ until the TV programme channel number you want to record is displayed on the TV PROGRAM indicator ⑬.
   - In the Programme Set mode, the TV PROGRAM buttons are inoperative and the channel skipping function is not in effect.
3. Press the SELECT button ㊺, and then "1st SUN" will start flashing.
4. Press the SET button ㊻ to specify the day.
   - Pressing it once advances the indication by one day and holding it pressed advances the indication rapidly.
   - The sequence of indication changing is: from SUN to SAT of the 1st week, then from SUN to SAT of the 2nd week, then everyday from SUN to SAT of the 1st week, then returning to the original condition.
5. Press the SELECT button ㊺, and then the "hour" digit will begin flashing.
6. Press the SET button ㊻ to obtain a desired hour indication.
7. Press the SELECT button ㊺, and then the "minute" digits will begin flashing.
8. Press the SET button ㊻ to specify a desired minute indication.
9. Press the SELECT button ㊺, and the REC LENGTH digits will begin flashing.
10. Press the SET button ㊻ to obtain a desired recording length.
    - The recording length can be set within 395 minutes in 5-minute steps.
11. Now you have finished presetting the timer for program "1" . If you need to enter another preset programme, press the PROG NO button ㊸, and "2" will be displayed on the PROGRAM NO indicator ⑦ for the next programme setting. You can follow the same procedure as instructed above.
12. When you have finished all necessary presettings to future programmes, set the CLOCK button ㉝ to return to the Clock mode.
13. After having programmed the timer, be sure to load a cassette, making sure that the TUNER button is pressed in and pressing the TIMER button following the instructions given below.

Repeating the preset programmes

- Normally the preset data are cleared after a recording has been made accordingly. However, if you wish to hold the preset data in memory in order for recordings to be made repeatedly according to this same data (for example, at the same time on the same day every week), press the PROG REPEAT button ㊷. The programme repeat indicator ⑥ will light.

Cancelling the preset programmes

- The preset programmes can be cancelled by pressing the CANCEL button ㊹ after calling up the corresponding programme number on the display.
- If you wish to cancel all preset data for programmes 1 through 8, press the CANCEL button ㊹ while simultaneously holding the PROG NO button ㊸. Then all programmes will be cleared and programme No. 1 will be displayed.
- Simultaneous cancelling all the preset programmes is not possible with the remote control unit.

Notes

- During the Programme Set mode, if no command is entered within 70 seconds, the Clock mode will be automatically engaged. If you have not yet finished setting the programme, press the PROG SET button once again.
- The preset data can be called up any time for checking by engaging the Programme Set mode and calling up the relevant programme number.
- If you wish to change the preset data partially, press the SELECT button in the Programme Set mode until the corresponding item starts flashing on the display and enter the new data by pressing the SET button. However, the repeat information cannot be changed separately. If you wish to change from "repeat" to "non-repeat", you have to cancel the relevant programme entirely by using the CANCEL button.
- If a power failure should occur (and last longer than about one hour), not only time-keeping stops (see page 1-13), but also all the preset data will be cancelled. A flashing SUN 88:88 00 indicates this after power has been reapplied. In such cases, first correct the time indication and then re-enter the programming data.

1.17 HOW TO SET THE RECORDER FOR UNATTENDED RECORDING

After having programmed the timer, prepare the recorder section for unattended recording.

1. Load a cassette.
   - Make sure that the tape length is sufficient for the sum of your intended recordings.
   - Make sure that the safety tab of the cassette is in place.
2. Press the TUNER button among the REC SELECT buttons ㉟.
   - The TUNER indicator will light.
3. Press the TIMER button ⑱.
   - The TIMER indicator will light, with the TUNER indicator turning off.
   - When the preset switch-on time is reached, recording will start automatically.
   - There is no need to press the REC and PLAY buttons to engage the Recording Standby mode.

Notes

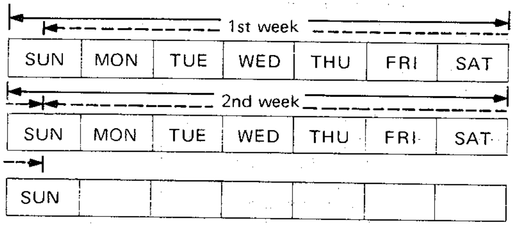
- Tape loading starts 10 seconds before the preset switch-on time and recording starts exactly at the preset time.
- After the unattended recording has been made, press the sub-power OFF button.

1.18 FOR A BETTER UNDERSTANDING OF THE PROGRAMMABLE TIMER

Two-week timer

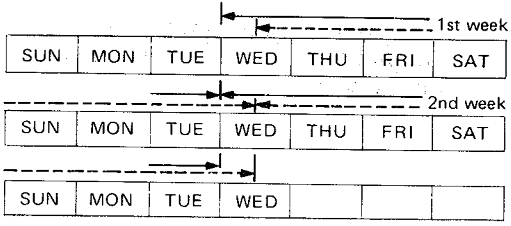
"Two-week" presetting capacity means that you can "reserve" recordings on any one of 14 days in advance including the day of setting.

If the current day of setting is Sunday:



- In this situation, there may be no possibility of confusion in setting the day.
- Namely, the "1st MON" is Monday of the current week and the "2nd MON" is Monday of the next week. The same applies to other week days.
- Regarding Sunday, there are two different cases; one is that you are going to set the timer to a time before the current time of setting and the other is that the preset time is a time after the current time of setting.
- In the former case, the "1st SUN" is the next Sunday and the "2nd SUN" is the Sunday after next.
- In the latter case, the "1st SUN" is the current Sunday and the "2nd SUN" is Sunday of the next week.

If the current day of setting is Wednesday for example:



- Remember that the "1st MON", "1st TUE" and so on . . . mean the first coming Monday, the first coming Tuesday, and so on, and not Monday of the current week.
- Similarly, the "2nd MON", "2nd TUE" and so on . . . are the second coming Monday, the second coming Tuesday, and so on, and not Monday or Tuesday of the next week.
- If you are on Wednesday for example, and wish to record something on Tuesday of the next week, the preset data should be "1st TUE". To record on Thursday of the next week, set "2nd THU".
- Regarding Wednesday, the same as mentioned about Sunday on the left applies.

8-programme timer

"8-programme" presetting capacity means that you can have 8 separate programme entries which contain different programming data. Because of this capacity, you can even "reserve" 8 different TV programmes, either on the same day or on different days.

Each programme (No. 1 through No. 8) entry contains information on "TV programme channel number", "day", "switch-on time", "recording length" and "either single or repeat".

Example of the contents of one programme entry:

Programme number	TV programme channel number	Day	Switch-on time	Recording length	Repeat
2	12	1stWED	2:30	30 min.	–

Variety of setting possibilities

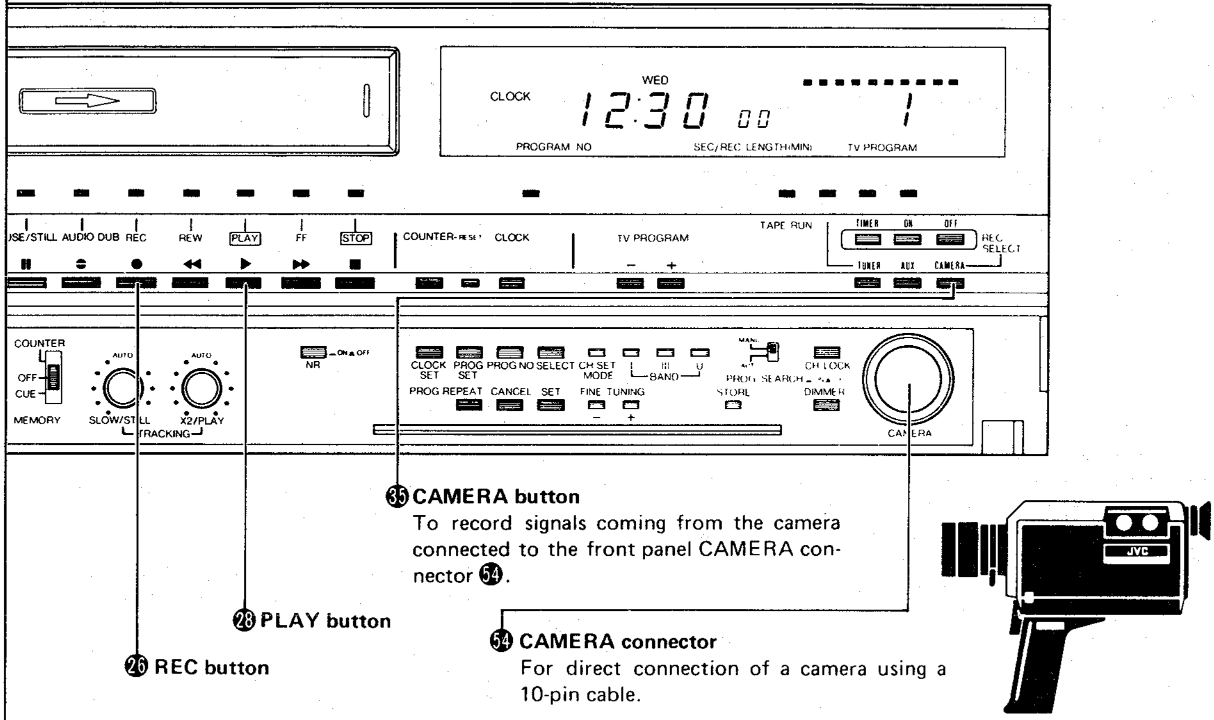
- You can set for some day of the 1st week or the 2nd week.
- You can set for one day of every week by first setting that day of the 1st week and pressing the PROG REPEAT button.
- You can set for one day of every other week by first setting that day of the 2nd week and pressing the PROG REPEAT button.
- You can set for all days of the 1st week. For this setting, obtain the indication "1st SUN MON TUE WED THU FRI SAT", and recordings will be repeated at the same time everyday for one week.
- You can set for all days week after week. For this setting, first obtain the indication as mentioned above and then press the PROG REPEAT button. And recordings will be made everyday week after week.
- All the above applies for all 8 programme entries.

Programme priority

- If you have preset two programmes for the same day and the same switch-on time, the setting corresponding to the smaller programme number has priority.
- If two programmes have preset times which overlap, the earlier-started programme will be interrupted by the latter one.
- It is impossible to alter the programmed data (except the recording length) during actual timer recording.
- The recording length can be changed even during timer recording by using the SELECT and SET buttons in the Programme Set mode.

1.19 HOW TO RECORD WITH A VIDEO CAMERA

Basic guidelines


CLOCK
WED
12:30
00
1
PROGRAM NO
SEC/REC LENGTH(MIN)
TV PROGRAM
JSE/STILL
AUDIO DUB
REC
REW
PLAY
FF
STOP
COUNTER-RESET
CLOCK
TV PROGRAM
TAPE RUN
TIMER
ON
OFF
REC SELECT
TUNER
AUX
CAMERA
COUNTER
OFF
CUE
MEMORY
AUTO
SLOW/STILL
X2/PLAY
TRACKING
NR
ON OFF
CLOCK SET
PROG SET
PROG NO SELECT
CH SET
MODE
BAND
PROG REPEAT
CANCEL
SET
FINE TUNING
PROG SEARCH
STORE
CH LOCK
DIMMER
CAMERA
JVC

㉟ CAMERA button
To record signals coming from the camera connected to the front panel CAMERA connector (54).

㉘ PLAY button

㉖ REC button

(54) CAMERA connector
For direct connection of a camera using a 10-pin cable.

When a camera is connected to the CAMERA connector and the CAMERA button is pressed, it is powered through the recorder and scenes being shot by the camera will appear on the TV screen.

Procedure

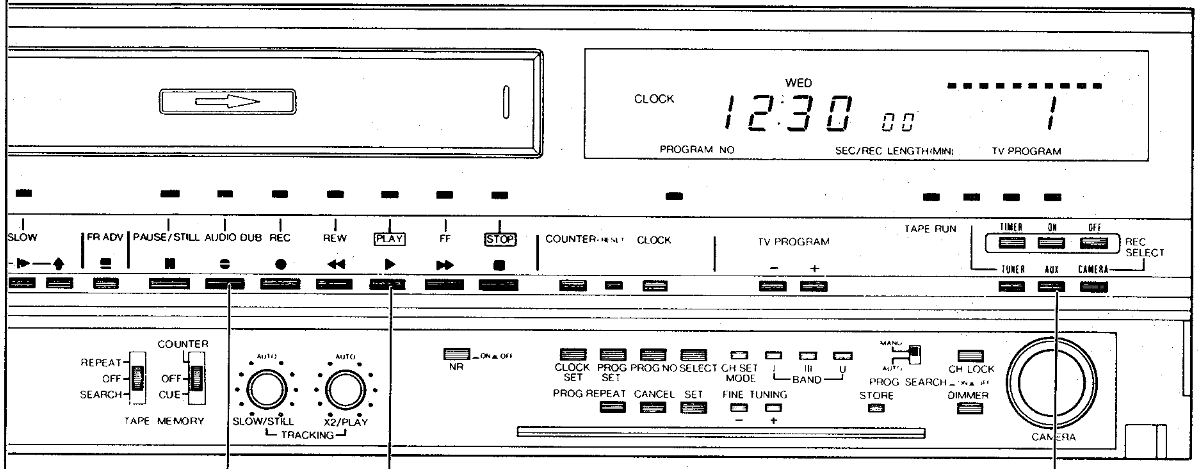
1. Connect a camera.
2. Press the sub-power ON button ⑱.
3. Switch on the TV receiver.
4. Set the TV receiver's channel selector to your VIDEO CHANNEL.
5. Press the CAMERA button ㉟.
   - You can monitor the scenes being shot by the camera.
6. Load a cassette.
7. Press the REC and PLAY buttons ㉖ ㉘ simultaneously. The recorder enters the Recording Standby mode.
   - When a camera is connected, starting or stopping of the tape is remote-controlled by the camera. Therefore, pressing the REC and PLAY buttons does not yet start the tape-running operation.
8. Operate the camera's start/stop switch. Now recording will start.

Notes

- If feedback noise (whistling or howling) is heard from the TV receiver, reduce the volume or move the microphone, either external or built within the camera, farther away from the TV receiver.
- Power to the camera is switched on or off with the ON and OFF buttons, by using the built-in timer, or by the remote control unit.
- With some cameras, their battery warning indicator may flicker, however, no problem occurs with recording as long as the picture being monitored on the TV screen appears normal.
- Some cameras may be connected to the rear panel VIDEO IN and AUDIO connectors via an appropriate adapter. In such cases, press the AUX ㉟ button instead of the CAMERA button.

1.20 HOW TO PERFORM AUDIO DUBBING

Basic guidelines


CLOCK
WED
12:30
PROGRAM NO
SEC/REC LENGTH(MIN)
TV PROGRAM
SLOW
FR ADV
PAUSE/STILL
AUDIO DUB
REC
REW
PLAY
FF
STOP
COUNTER-RESET
CLOCK
TV PROGRAM
TAPE RUN
TIMER
ON
OFF
REC SELECT
TUNER
AUX
CAMERA
COUNTER
REPEAT
OFF
SEARCH
OFF
CUE
TAPE MEMORY
AUTO
AUTO
SLOW/STILL
X2/PLAY
TRACKING
NR
CLOCK SET
PROG SET
PROG NO SELECT
CH SET
MODE
BAND
PROG REPEAT
CANCEL
SET
FINE TUNING
PROG SEARCH
STORE
CH LOCK
DIMMER
CAMERA

㉕AUDIO DUB button
To start audio dubbing.

㉘PLAY button

㉟AUX button
To record signals from the rear panel AUDIO connector.

Audio dubbing means recording a sound track on a pre-recorded cassette. Sound from a source connected to the rear panel AUDIO connector, or from a microphone connected to the front panel MIC jack, or a mixture of the two can be recorded. The previously recorded sound is erased and replaced with a new sound track by audio dubbing.

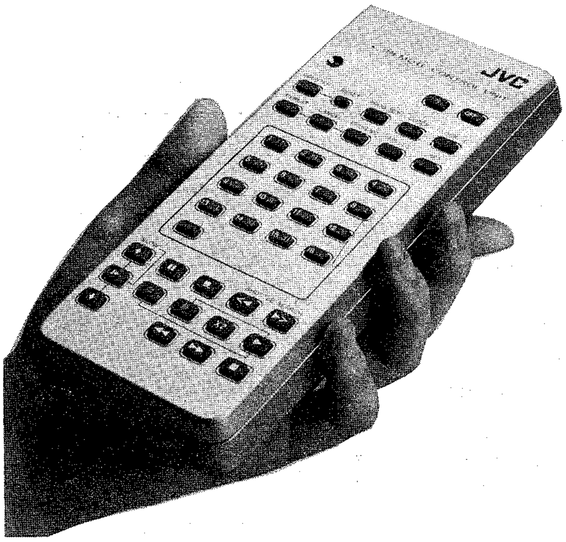
Procedure

1. Load a pre-recorded cassette.
2. Set the TV receiver's channel selector to your VIDEO CHANNEL to monitor the playback picture while dubbing audio.
3. Press the AUX button ㉟.
   - If you record sound only from the microphone, the AUX button need not be pressed.
4. Press the AUDIO DUB and PLAY buttons ㉕ ㉘ simultaneously. The AUDIO DUB and PLAY indicators will light and audio dubbing will start.

Notes

- Use a high-impedance microphone.
- If whistling or howling is heard during audio dubbing, reduce the TV volume or move the microphone farther away from the TV. Recording is being performed even if sound is not heard from the TV receiver. If you want to monitor the sound being recorded, connect headphones to the HEADPHONES jack.
- The pause function facilitates audio dubbing. First play back the pre-recorded tape and press the PAUSE/STILL button at the point from which you wish to start audio dubbing. If necessary, adjust the point by using the FR ADV button. Then press the AUDIO DUB and PLAY keys simultaneously. This permits you to start audio dubbing exactly at the right point.
- Even though you are playing back the tape in the Double-Speed (X2) mode, normal speed is automatically resumed when the Audio Dub mode is engaged.

1.21 FEATURES OF THE REMOTE CONTROL UNIT

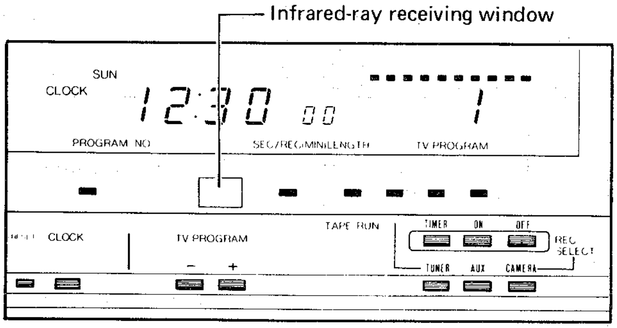


- This remote control employs infrared-ray transmission.
- Main operational buttons on the recorder are duplicated on the remote control unit for at-a-distance operation.
- All tape control modes (except EJECT), TV programme channel selection, timer programming and clock setting are possible via the remote control unit.
- There is no possibility of cross-modulation or mis-operation from other infrared remote control units.
- Low power consumption; lasting about 1 year with four easily-obtainable "R6" batteries.

1.22 PRECAUTIONS FOR THE REMOTE CONTROL UNIT

- When you have switched the power off via the remote control unit, even though the sub-power ON button on the recorder is pressed in, the recorder is inoperative (with the ON indicator turned off).

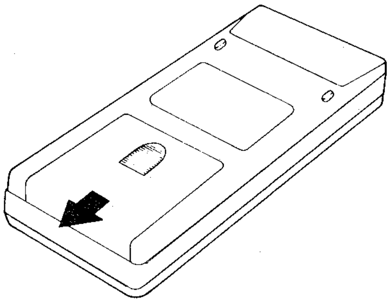
  To re-apply power to the recorder, either press the ON button on the remote control unit or first press the sub-power OFF button on the recorder and then press the sub-power ON button again.
- Do not attempt to press two buttons simultaneously (except PLAY and REC or PLAY and AUDIO DUB), otherwise malfunctioning may result.
- If the LED indicator fails to light when one of the buttons is pressed after the remote control unit has been used for a long time, the battery power is insufficient. Replace all 4 batteries with fresh ones following the instructions.



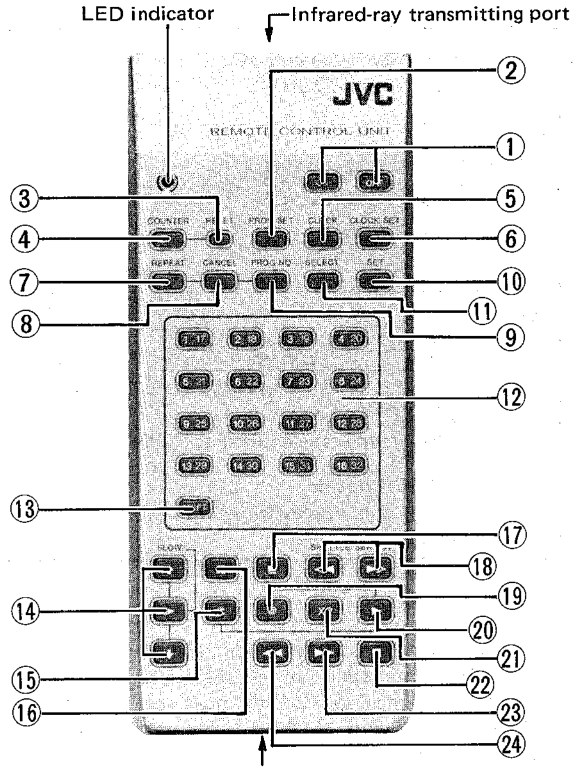
- Since the infrared-ray receiving window is located above the TV PROGRAM −/+ buttons, direct the infrared-ray transmitting port of the remote control unit (see next page) toward this window when controlling the recorder via the remote control unit.

1.23 HOW TO INSTALL THE BATTERIES

1. Slide the battery compartment cover on the rear of the unit in the direction of the arrow (►).
2. Insert 4 "R6"-size batteries (provided) according to the polarity instructions printed in the battery compartment.
   - Position the ribbon underneath the batteries for easy removal later.
3. Replace the cover.



1.24 HOW TO USE THE REMOTE CONTROL UNIT



Battery compartment

- Direct the infrared-ray transmitting port toward the recorder's receiving window.
- The function of each button is exactly the same as that of the corresponding button on the recorder.
- For TV programme channel selection, 17 buttons (16 double-numbered buttons and a SHIFT button) are provided instead of the two TV PROGRAM -/+ buttons on the recorder.
- When any one of buttons is pressed, the remote control indicator ⓮ on the recorder will light momentarily to indicate that it is receiving a signal.
- The LED indicator on the remote control unit also lights to indicate that it is transmitting a signal.
- The channel skipping function is not in effect when selecting a channel with the remote control unit. When a skipped channel is selected, the TV screen usually shows snow noise.

① **ON/OFF buttons**
To switch power on or off for the recorder.
Notes
- These buttons are not to switch the power circuit of the remote control unit itself on or off. The remote control unit is always ready to operate. It consumes power only at the time the buttons are being pressed.
- In order for the remote control unit to be able to switch the power for the recorder on or off, the recorder's sub-power ON button should be pressed in.

② **PROG SET button**
To engage the Programme Set mode.

③ **RESET button**
To reset the tape counter to "0000".

④ **COUNTER button**
To change the display from the Clock mode to the Tape Counter mode.

⑤ **CLOCK button**
To return the display to the Clock mode from any other mode.

⑥ **CLOCK SET button**
To engage the Clock Set mode for time adjustment.

⑦ **REPEAT button**
To hold the programming data for repeated recording.

⑧ **CANCEL button**
To cancel the entered programming data.

⑨ **PROG NO button**
To call up a programme memory on which programming data are to be entered.

⑩ **SET button**
To enter the necessary data for each selected item to be set in the Programme Set mode or in the Clock Set mode.

⑪ **SELECT button**
To select the item for setting in the Programme Set mode or in the Clock Set mode.

⑫ **TV programme channel number buttons**
Press the desired number button. The selected number will be displayed on the TV PROGRAM indicator.
For selecting channels between 16 and 32, press the button carrying the relevant number and then press the SHIFT button⑬.

⑬ **SHIFT button (EG only)**
To shift the channel number by 16 channels. For selecting a channel exceeding 16, first press the relevant channel number button and then press this button.

⑭ **SLOW buttons (⬆) (▮►) (⬇)**
To view slow-motion playback. Press the centre " ▮► " button while in the Play mode. Then, if you wish to accelerate the slow-motion speed, press the upper "⬆" button, and to decelerate, the lower "⬇" button, until you get the desired speed.

⑮ **AUDIO DUB button (≑)**
Press together with the PLAY " ► " button for starting audio dubbing.

⑯ **PAUSE/STILL button (▮▮)**
To stop the tape temporarily during recording or to view a still picture during playback.

⑰ **FRAME ADVANCE button (≡)**
To advance the playback picture frame by frame in the Still mode.

⑱ **SHUTTLE SEARCH buttons (<◄) (►>)**
To rapidly transport the tape (at 10 times normal) in either direction to locate the desired tape section.

⑲ **REC button (●)**
Press together with the PLAY button " ► " for starting recording.

⑳ **PLAY button (►)**
To play back the tape.

㉑ **X2 button (X2)**
To play back the tape at a speed twice the normal.

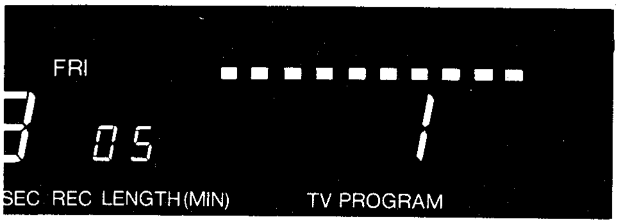
㉒ **STOP button (■)**
To stop the tape.

㉓ **FF button (►►)**
To fast forward the tape.

㉔ **REW button (◄◄)**
To rewind the tape.

1.25 HOW TO READ THE REMAINING-TAPE-LENGTH INDICATOR

Tuner sweep/Tape-remaining-length indicator



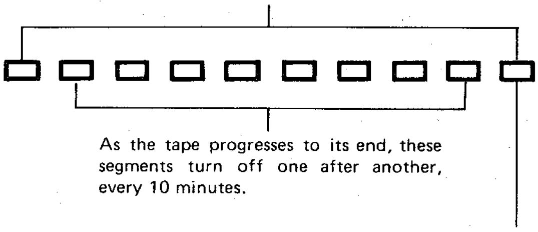
These ten segments of the indicator function as a tape-remaining-length indicator in the Record or Play mode.

- As per the tape remaining length, the number of illuminated segments will reduce from the left side.
- Each segment corresponds to about 10 minutes of tape running time. This means more than 100 minutes cannot be indicated. As long as a tape length of more than 100 minutes remains, all 10 segments remain lighted.
- During double-speed playback, one segment turns off per 5 minutes.
- When the tape reaches its last about 5 minutes, the rightmost segment will start flashing as a warning that the tape is nearing its end.
- It takes about 15 to 20 seconds for the indicator to light after the tape has started running. (With some tapes, about 30 seconds may be needed.)
- In the Fast Forward and Rewind modes (also in the Shuttle Search mode), the indicator is not illuminated.

Example

When you insert a fully-rewound 120-minute cassette:

For the first 30 minutes, all segments are illuminated. After the first 30 minutes the leftmost one turns off.

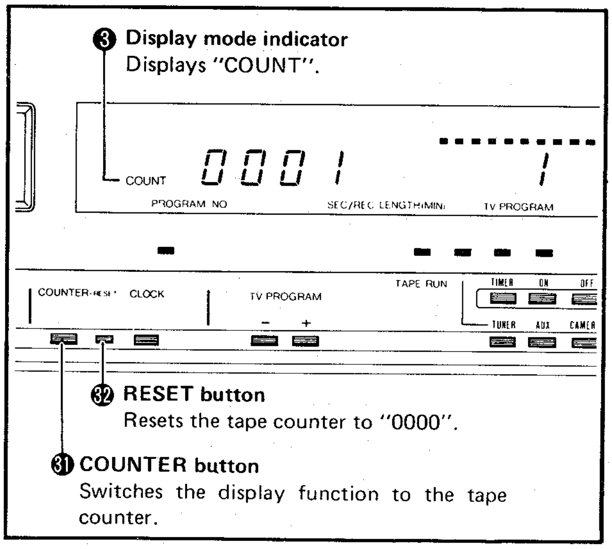


As the tape progresses to its end, these segments turn off one after another, every 10 minutes.

For the final 5 minutes, the rightmost segment continues flashing.

- It may happen that 4 or 7 segments are illuminated when you insert a fully-rewound 30-minute or 1-hour cassette, respectively. This is not due to any defect of the indicator, but video cassettes usually contain slightly more length of tape than indicated in the specifications.
- Correct indication may not be obtained with demonstration tapes or other special-purpose tapes since such tapes sometimes contain different lengths of tape than labelled on the cassettes.
- If you play a blank tape, random indication will result.

1.26 HOW TO USE THE TAPE COUNTER



③ **Display mode indicator**
Displays "COUNT".

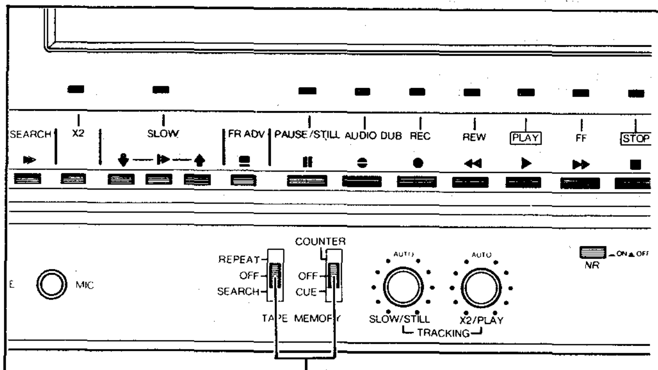
㉜ **RESET button**
Resets the tape counter to "0000".

㉛ **COUNTER button**
Switches the display function to the tape counter.

The tape counter is helpful for tape indexing. When the COUNTER button ㉛ is pressed, the display changes from the Clock mode to the Tape Counter mode showing 4 digits (from 0000 to 9999), with "COUNT" illuminated on the display mode indicator.

- The tape counter functions in all tape modes.
- Pressing the RESET button ㉜ resets the counter reading to "0000".
- When used in conjunction with the TAPE MEMORY switches (see page 1-27), the tape counter will provide more versatile usage.

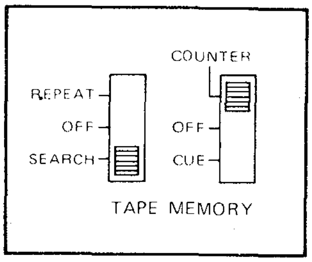
1.27 HOW TO USE THE TAPE MEMORY SWITCHES


SEARCH
X2
SLOW
FR ADV
PAUSE/STILL
AUDIO DUB
REC
REW
PLAY
FF
STOP
MIC
COUNTER
REPEAT
OFF
SEARCH
OFF
CUE
TAPE MEMORY
AUTO
AUTO
SLOW/STILL
X2/PLAY
TRACKING
ON OFF
NR

㊳ **TAPE MEMORY switches**
To search for a particular tape section or to repeat playback automatically.

Several different functions are available depending on the combination of settings of these two switches. To search for a specific tape section, you can apply either the counter search or cue search mode. To repeat playback automatically, there are the counter repeat, full repeat and cue repeat modes.

Counter search function

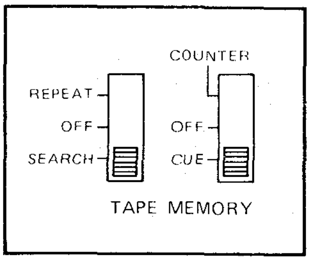

COUNTER
REPEAT
OFF
SEARCH
OFF
CUE
TAPE MEMORY

Left switch: SEARCH
Right switch: COUNTER

- The display should be changed to the Tape Counter mode.

With this combination of switch settings, the point corresponding to the tape counter reading of "0000" is automatically located in the Fast Forward or Rewind mode. Therefore, its typical use may be: (1) press the RESET button at the start of playback and (2) after playback, rewind the tape. Then the tape automatically stops when the counter reaches "0000", facilitating the location of the tape section you want to playback again.

Cue search function


COUNTER
REPEAT
OFF
SEARCH
OFF
CUE
TAPE MEMORY

Left switch: SEARCH
Right switch: CUE

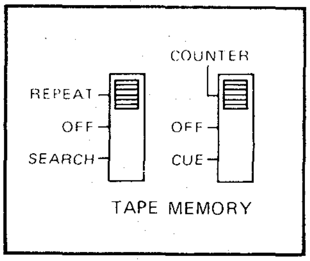
At the beginning of every recording, a cue signal is recorded on the tape. The cue search function enables the sensing of this cue signal and stops the tape at a point where a new recording was made.

Similarly to the counter search function, this mode is applicable only in the Fast Forward and Rewind modes. If you wish to view the recorded material immediately after it was made, employ these switch settings. After recording, if you rewind the tape, it stops automatically where the recording was initiated (the cue signal position).

Notes

- The cue signal is recorded in the following cases:
  (1) When a recording is initiated from the Stop mode; STOP – REC.
  (2) When a timer recording is initiated; TIMER ON – REC.
  (3) When a recording is initiated from the Play mode by pressing the PLAY button once again, together with the REC button.

Counter repeat function

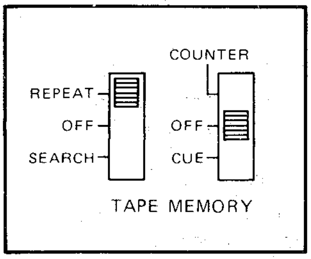

COUNTER
REPEAT
OFF
SEARCH
OFF
CUE
TAPE MEMORY

Left switch: REPEAT
Right switch: COUNTER

- The display should be changed to the Tape Counter mode.

If you wish to play back part of the tape repeatedly, especially from the beginning to a certain point, employ these settings and specify the ending point of playback by resetting the tape counter to "0000". Then, repeated playback is obtained between the beginning of the tape and the point of the "0000" counter reading.

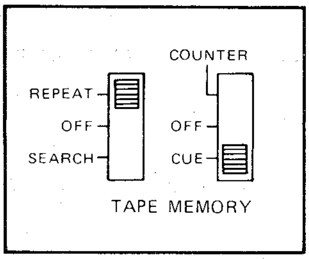
Full repeat function



Left switch: REPEAT
Right switch: OFF

With this combination of switch settings, the tape will be automatically rewound at its end (as usual) and played back repeatedly when it reaches its beginning. The entire tape can be played back again and again automatically.

Cue repeat function



Left switch: REPEAT
Right switch: CUE

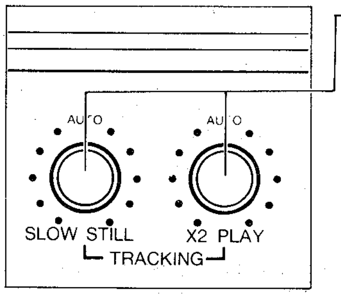
- The display should be changed to the Tape Counter mode.

Both the counter reading of "0000" and the cue signal are detected for automatic playback repeat. It means that the tape is automatically played back again and again for only the part between the cue signal and "0000". Employ this mode, for example, when you wish to view repeatedly a particular part after the point where recording was initiated, by specifying the ending point of playback through resetting of the counter.

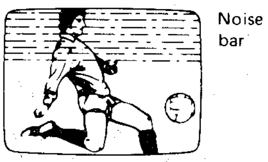
Operation chart for the TAPE MEMORY switches

Left switch / Right switch	REPEAT	OFF	SEARCH
COUNTER	Repeated playback from the beginning to "0000".	No function.	Automatic stop at "0000" in the FF and Rewind mode.
OFF	Repeated playback of the entire tape.	No function.	No function.
CUE	Repeated playback from the cue signal to "0000".	No function.	Automatic stop at the cue signal in the FF and Rewind mode.

1.28 HOW TO USE THE TRACKING CONTROLS



㊴ **TRACKING controls**
To eliminate noise bars on the TV screen.



If the playback picture contains noise bars (this is likely to happen when you play back a cassette which was recorded with a different video recorder unit), adjust the TRACKING controls.

During normal-speed or double-speed playback

Use the right TRACKING control labelled X2/PLAY.

Turn it slowly in either direction until the noise bars move out of the picture frame.

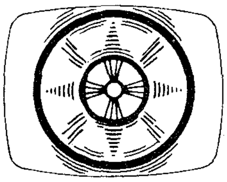
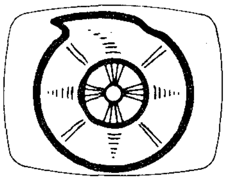
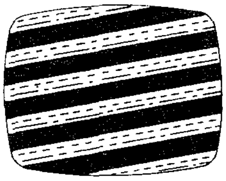
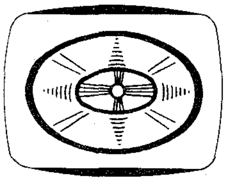
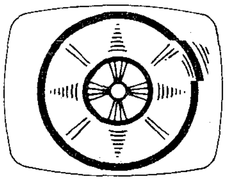
During slow-motion or still-frame playback

Use the left TRACKING control labelled SLOW/STILL.

Note
After playing back that particular cassette, be sure to return the TRACKING controls to their centre AUTO position.

1.29 ADJUST YOUR TV RECEIVER WHEN....

Speed or Still Playback may require adjusting your TV receiver. If your TV receiver shows the following symptoms during Speed Playback or Still Playback using the HR-7700E, adjust the TV receiver first.

Symptom	Adjustment
Picture vibrates vertically. 	Turn the V-Hold knob slightly for stabilizing.*
The upper portion of the picture drifts horizontally. 	Turn the H-Hold knob slightly for stabilizing.**
Picture rolls. 	Turn the H-Hold knob slightly for stabilizing.**
Picture is flattened vertically. 	Inherent in your TV receiver.
Only a portion of the picture continues to flicker. 	Not adjustable. Inherent in your TV receiver.

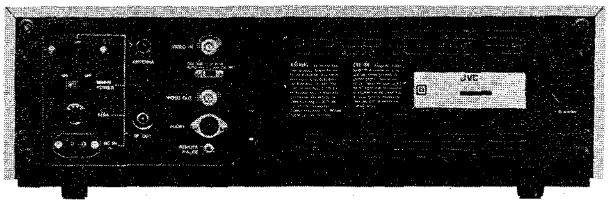
HEAD CLEANING

Picture playback may become blurred or interrupted while the TV programme received is clear. This does not mean that the recorded programme has been erased. Dirt accumulated on the head after long periods of use causes such troubles. In this case, head cleaning requiring highly technical care is necessary.

* For head cleaning,

If the V-Hold and H-Hold knobs are not provided on your TV receiver,

*If an unsatisfactory result is obtained, adjust the V. LOCK ADJ (Vertical Lock Adjustment) knob located at the rear of the unit so that a stable picture is obtained.



**If an unsatisfactory result is obtained, it is necessary to adjust the AFC circuit of the TV receiver.

1.30 IN CASE OF DIFFICULTY

What may initially appear to be trouble is not always a real problem. Make sure first . . .

Symptoms	Check points
No power is applied to the set.	● Is the power cord disconnected? – Connect it. ● Is the rear panel POWER switch set to OFF? – Set to ON.
Clock is functioning properly, but the set is not powered with the recorder's ON button pressed in.	● Have you switched the power off last via the remote control unit? – If so, press the recorder's OFF button once and then press the recorder's ON button again. – Or simply press the remote control unit's ON button.
Playbeck picture does not appear while the tape is running.	● Is the TV receiver's channel selector set to the correct video channel? – Set to the RF converter channel. (See page 10.)
REC or AUDIO DUB button cannot be pressed in.	● Is the safety tab on the video cassette broken? – Reseal the slot with cellophane tape.
Tape stops unexpectedly.	● Check the settings of the TAPE MEMORY switches. See pages 27 and 28.
Buttons for variable-speed playback do not function.	● Have you pressed the PLAY button first? – If not, press it.
Timer-recorded material is different from intended.	● Check to see if the length of tape is sufficient to accommodate all the intended recordings. If not, after reaching its end, tape will be rewound automatically to the beginning and may record according to the next programme entry, if any.
Noise such as whistling or howling is heard from TV while audio dubbing or camera recording.	● Move microphone or camera away from TV or reduce TV sound volume.

SECTION 2
MECHANISM DESCRIPTION

2.1 GENERAL

As this machine conforms to VHS specifications, it is fully interchangeable with earlier models in the VHS format. For this reason, the basic principles of the mechanism, particularly the tape transport system, are identical to previous VHS machines.

Among the major differences between this and earlier models are the front panel cassette loading system, infrared remote control system and light-touch push button operation. Mode selection is performed by using two solenoids and five DC motors.

The solenoids and motors are controlled by the mechanism control circuit (mechacon). Individual mechanical parts have been considerably reduced in number compared to previous machines, resulting in a simplified mechanism with enhanced reliability and serviceability.

The following description covers operations in each mode. It is also recommended to refer to the description of the mechanism control circuit.

2.2 STOP MODE

Fig. 2-1 shows a top view of the mechanism in the Stop mode with the cassette housing removed. The main solenoid, pinch roller solenoid, loading, reel, drum and capstan motors are off. Brakes are applied to both the supply and take-up reel disks, preventing them from rotating.

The reel idler is stopped and separated from both reel disks. Pinch roller and capstan shaft are not in contact. The guide rollers, slant poles and tension poles mounted to the supply and take-up pole bases are positioned to allow acceptance of cassette tape.

The unloading (UL) switch is mechanically on (but electrically off) and the after loading (AL) switch is off.

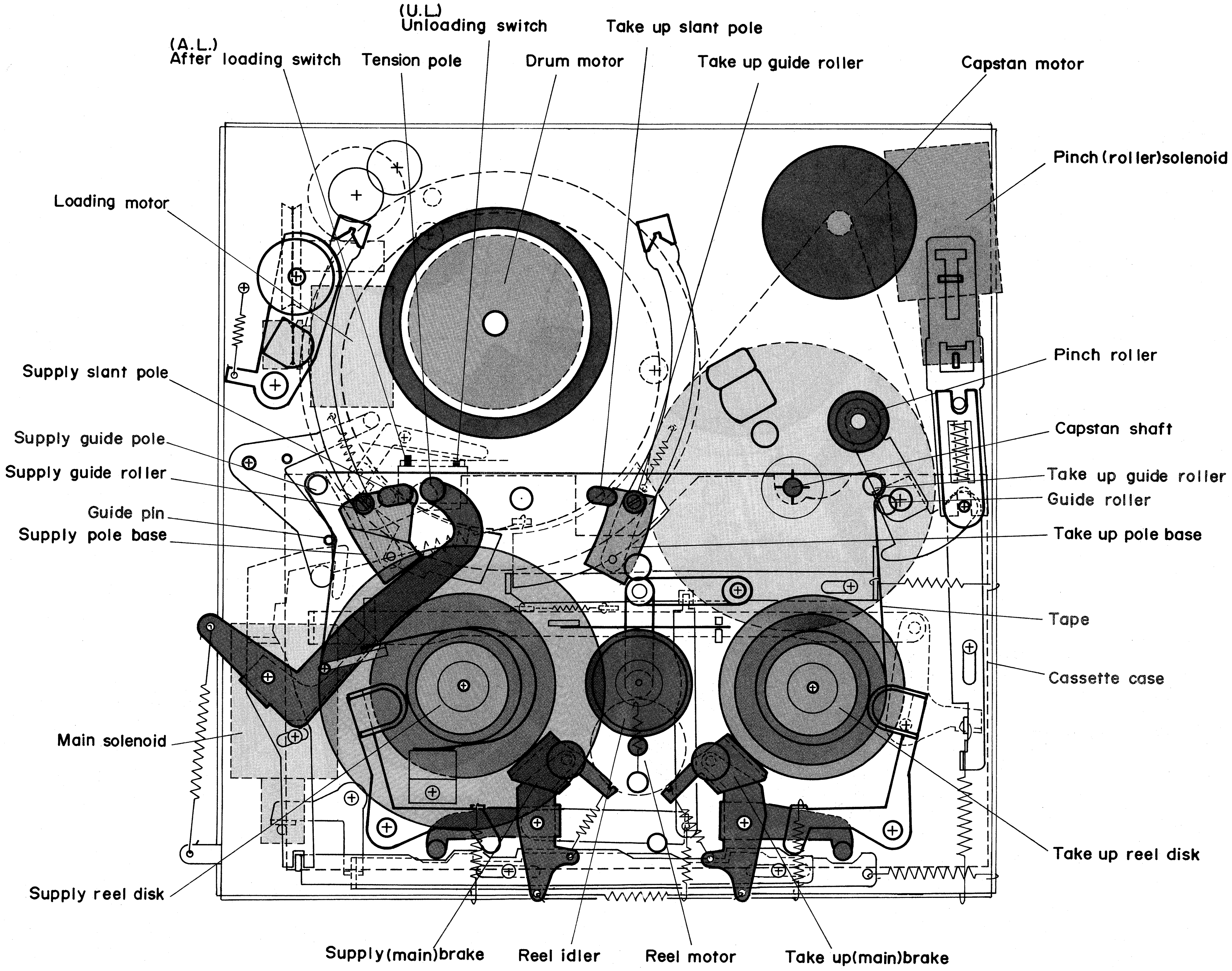

(U.L.)
Unloading switch
Take up slant pole
(A.L.)
After loading switch
Tension pole
Drum motor
Take up guide roller
Capstan motor
Pinch (roller)solenoid
Loading motor
Pinch roller
Supply slant pole
Capstan shaft
Supply guide pole
Supply guide roller
Take up guide roller
Guide roller
Guide pin
Supply pole base
Take up pole base
Tape
Cassette case
Main solenoid
Take up reel disk
Supply reel disk
Supply (main) brake
Reel idler
Reel motor
Take up (main) brake

Fig. 2-1 Stop mode mechanism

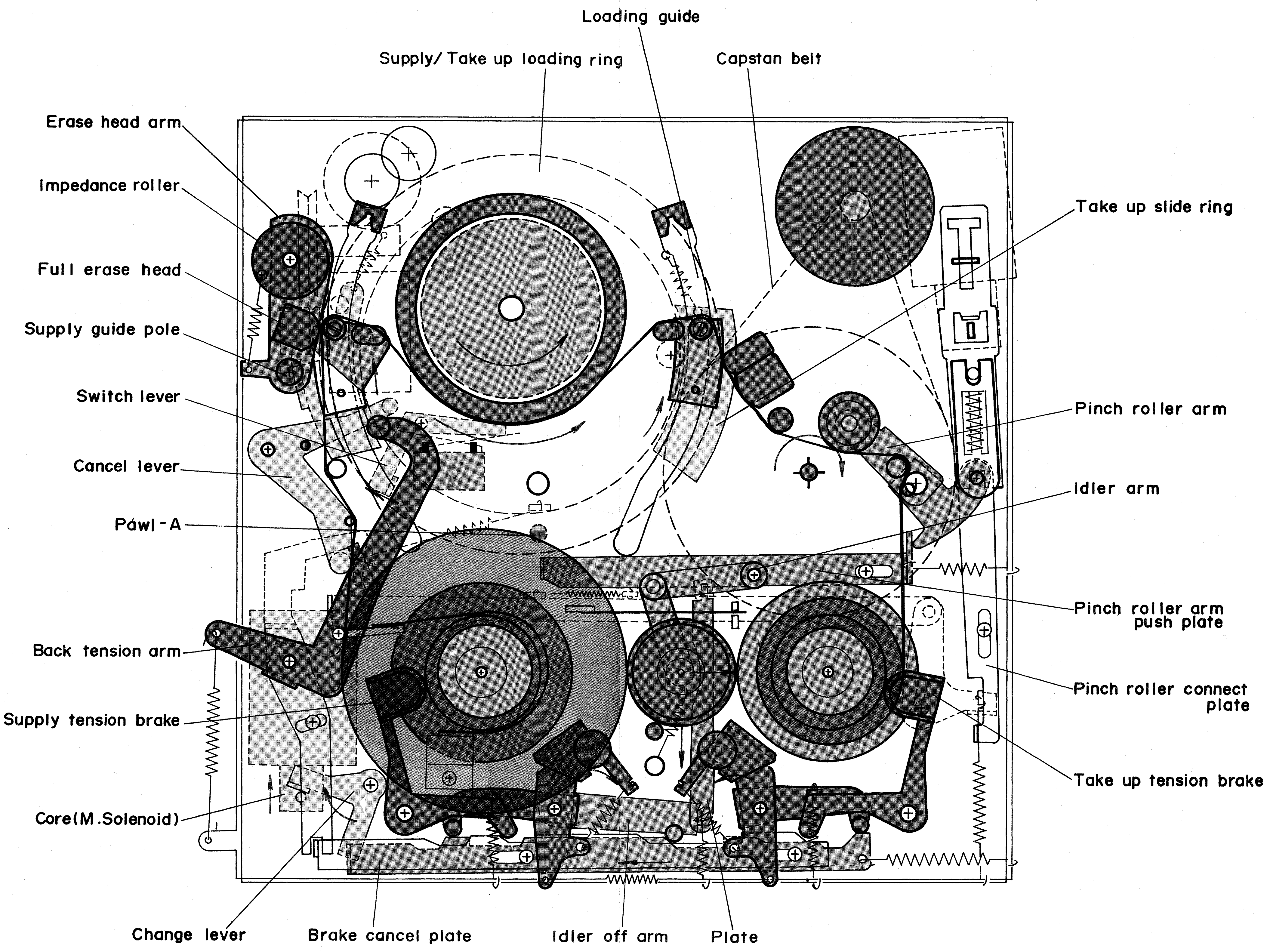

Loading guide
Supply/ Take up loading ring
Capstan belt
Erase head arm
Impedance roller
Full erase head
Supply guide pole
Switch lever
Cancel lever
Páwl - A
Back tension arm
Supply tension brake
Core(M.Solenoid)
Take up slide ring
Pinch roller arm
Idler arm
Pinch roller arm push plate
Pinch roller connect plate
Take up tension brake
Change lever
Brake cancel plate
Idler off arm
Plate

Fig. 2-2 Loading mode machanism

Pressing the PLAY button in the Stop mode sets the main solenoid on. The solenoid core stroke rotates the change lever. This overcomes the spring force and the brake cancel plate slides toward the left. The supply and take-up brake studs, which had been resting in the indented sections of the brake cancel plate, then ride up on the raised portions. This releases the supply and take-up reel brakes (brake off state).

By the brake cancel plate motion, the plate locking the idler off arm and idler arm is pulled forward, releasing the idler arm and allowing the reel idler to move freely left or right. A spring presses the reel idler against the reel motor. At this time, the reel motor rotates briefly in the clockwise (forward) direction.

The reel idler turns in the forward direction and contacts the take-up reel disk. The reel motor then stops, but since the main solenoid is on, the reel idler remains in contact with the disk.

At this time, the loading motor begins rotating in the forward direction. The rotation is transferred via belt and gears to the supply and take-up loading rings. This process is shown in Fig. 2-3.

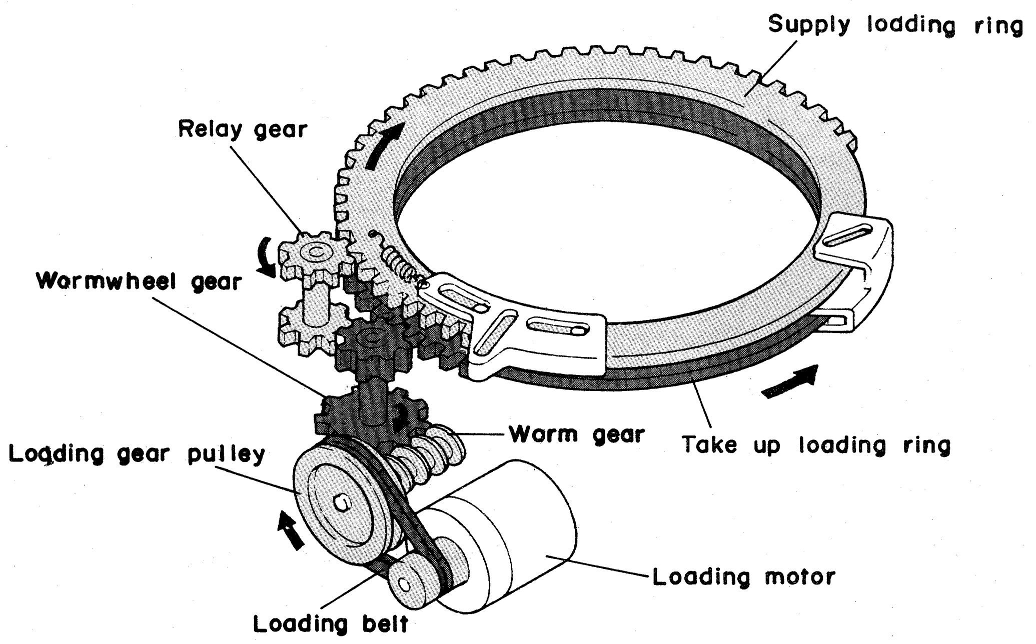


Fig. 2-3 Loading motor driver mechanism

The loading motor rotation is transferred in the route: loading motor → loading belt → loading gear pulley → worm gear → wormwheel gear → relay gear ass'y → supply and take-up loading rings. As the loading rings begin turning, the switch lever, which is locked by pawl-A at the bottom of the take-up loading ring, becomes free. The UL switch becomes off and the drum and capstan motors start rotating.

Notes:

1. *At this time, the drum and capstan motors rotate in order to speed up locking of the drum and capstan servos during Play/REC.*
2. *In the direct drive cylinder system, the drum motor is directly coupled to the rotating video head drum.*
3. *The capstan motor drives the capstan shaft via the motor pulley, capstan belt and capstan flywheel.*

Via the loading rings, springs and slide rings, the pole bases attached to the loading rings engage the guides to perform loading. Guide poles and slant poles, mounted to these pole bases, extract the tape from the cassette. Since the tension brake and reel idler prevent the take-up reel disk from rotating, tape is extracted only from the supply reel.

Tension brake is applied to the supply reel disk in order to prevent tape slackening during the loading process.

Rotation of the take-up loading ring frees the pinch roller arm push plate, which was locked by the take-up slide ring. Spring tension slides this push plate toward the right. As the pinch roller arm moves in the capstan shaft direction, the pinch roller connect plate and other parts connected to the pinch solenoid move in the upward direction. The pinch roller on state produces the standby mode for contact between the pinch roller and capstan.

As loading proceeds, the back tension arm, locked by the supply pole base, moves by a spring in the counterclockwise direction to where it becomes locked by the cancel lever, preventing further rotation. In other words, the back tension arm and tension band do not apply tension braking to the supply reel disk during loading. The back tension arm assumes the standby state.

The supply guide pole, full erase head and impedance roller are mounted to the erase head arm. While the erase head arm is pressed aside, the supply pole base engages the loading guide to perform loading.

Notes:

1. *The cue head is mounted on the tape contacting face of the tension pole. Both cue head and tension arm functions are included.*
2. *When the main solenoid becomes on, a) the main brakes of the supply and take-up reel disks are released, and b) the reel idler contacts the reel disk to produce the standby mode.*
3. *The drum and capstan motors do not rotate when the UL switch is off (i.e., modes other than Play or REC).*

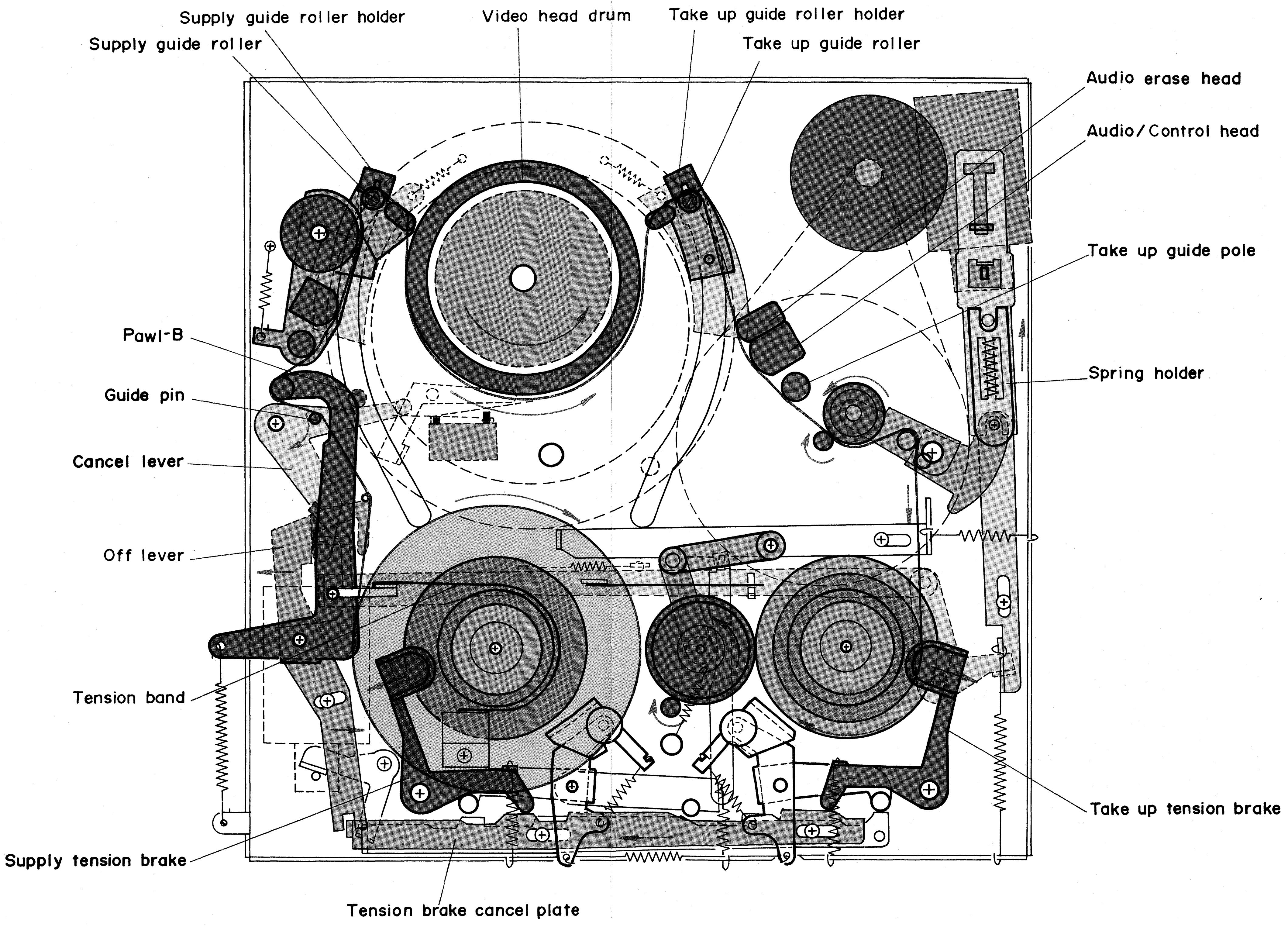

Supply guide roller holder
Supply guide roller
Video head drum
Take up guide roller holder
Take up guide roller
Audio erase head
Audio/Control head
Take up guide pole
Spring holder
Pawl-B
Guide pin
Cancel lever
Off lever
Tension band
Supply tension brake
Tension brake cancel plate
Take up tension brake

Fig. 2-4 Normal Play/Normal record mode mechanism

2.4.1 Normal Play/Normal record

Toward the end of the loading process, the supply and take-up guide rollers engage the V grooves of their respective guide roller holders. The loading ring continues briefly in loading. The slide ring and pole base are spring coupled to the loading ring. As the ring rotates further, the guide roller atop the pole base is locked by the guide roller holder and the pole base does not proceed further. In other words, the pole base is strongly pulled by the loading ring spring to firmly engage the guide roller in the V groove without vertical space.

When the supply guide roller engages the supply guide roller holder, the erase head arm again becomes free and spring force returns the full erase head and related parts to their specified positions.

In this state, pawl-B on the bottom of the take-up loading ring presses the cancel lever in the clockwise direction. This sets the AL switch on, stopping the loading motor and completing the loading process.

The pinch solenoid switches on and the pinch roller contacts the capstan shaft to begin tape running. The reel motor rotates at normal speed in the forward direction and tape transported by the capstan and pinch roller is taken up by the take-up reel. Movement of the cancel lever and pinch solenoid operation free the back tension arm. The tension band is applied to the supply reel disk and provides back tension for the normal Play/REC mode.

Via the off lever, clockwise rotation of the cancel lever slides the brake cancel plate toward the right. The studs of the supply and take-up tension brakes, which are positioned in the indented portion of the tension brake cancel plate, ride up on the raised portion. This releases the supply and take-up tension brakes from the reel disks to yield the normal Play/REC mode.

Only supply back tension from the tension arm and tension band operates at the supply reel disk. Starting from the supply reel, the tape path becomes: guide pin → supply guide pole → full erase head → impedance roller → supply guide roller → supply slant pole → video head drum → take-up slant pole → take-up guide roller → audio/control head → take up guide pole. The pinch roller and capstan shaft transport the tape, while the reel motor and reel idler drive the take-up reel for taking up the tape.

Notes:

1. *The guide pin at the supply side prevents the tape from rubbing against the cassette case as it is being extracted from the supply reel. By compensating for the positions of the supply guide pole and tension arm, the pin aids in maintaining perpendicularity.*
2. *The pinch solenoid is energized and pinch roller pressure obtained when the AL switch is on, i.e., only during the Play/REC mode.*
3. *Supply and take-up tension brakes are released from the reel disks at completion of loading (only in the Play/REC mode).*
4. *The supply back tension mechanism operates only at completion of loading with the pinch solenoid on.*

2.4.2 Pause

When the Pause mode is selected during the normal REC mode, the pinch rolenoid switches off and the pinch roller separates from the capstan shaft. A spring pulls the pinch roller connect plate forward. Via the connect lever, the tension arm cancel plate slides toward the right. The tension arm rotates slightly clockwise. Consequently, the tension band applies only a slight back tension to the supply reel disk.

For approx. 50 msec following pinch roller off, tape is taken up by the take-up reel in order to avoid tape slack. The main solenoid and reel motor are off. Supply and take-up brakes are applied to the reel disks and since the reel motor is off, the reel idler separates from the reel disk. (The main solenoid and reel motor are off briefly for 150 msec.)

The main solenoid and reel motor again switch on. However, the reel motor rotates in the rewind direction. This releases the main brake from both reel disks and the reel idler contacts the supply reel disk. For about 300 msec, the tape is rewound on the supply reel. Afterwards, the main solenoid and reel motor switch off to produce the stable Pause mode. This state is shown in Fig. 2-5.

When returning from the Pause to the Recording mode, the main solenoid switches on and the reel motor rotates in the forward direction. The pinch roller then contacts the capstan shaft to resume the Recording mode.

Notes:

1. *If the Recording mode has continued for less than one second, the tape is not rewound when switching to the Pause mode.*
2. *When changing from the REC to the Pause mode, pinch roller pressure is released and recording stops. Afterwards, the main solenoid and reel motor switch off, stopping the tape transport.*
3. *The reel idler contacts the supply reel disk and the amount of tape equivalent to 20 control pulses (20 TV frames) is rewound on the supply reel. The Pause mode is then obtained.*
4. *When returning from Pause to REC, 12 frames of the rewound tape is played back in order to obtain servo lock, then the Recording mode starts from the remaining 8 frames. The Recording mode resumes with the tape trace of the CH-2 head and 8 frames are overlapped, providing a smooth juncture between recorded segments. This set of operations comprises the ESC (edit start control) feature of this model.*

2.4.3 Still, Slow and Speed (X2) playback

When switching from normal Playback to Still, Slow or Speed modes, the capstan servo circuit controls the capstan motor for still, reduced speed (intermittent rotation) and double speed. At the return to normal Playback, the capstan motor again rotates at normal speed.

In the Still mode, the pinch roller remains in contact with the capstan shaft and rotation stops. However, the reel motor continues to operate to prevent tape slackening. This does not adversely affect the tape due to the low torque of the reel motor.

2.4.4 Shuttle search rewind and fast forward.

During the normal Playback mode, when shuttle search rewind (S-REW) is selected, the pinch solenoid switches off, releasing the pinch roller from the capstan shaft. The tension arm cancel plate pulls the back tension arm clockwise, reducing the tension brake applied to the supply reel disk by the tension band. The main solenoid switches off and brake is applied to both reel disks. Reel motor rotation stops and the reel idler separates from the take-up reel disk.

The main solenoid then switches on, releasing both reel disks. At this time, the reel motor rotates in the rewind direction and the reel idler contacts the supply reel disk. Afterwards, the reel motor increases speed to produce the search rewind mode.

The opposite of these operations is performed in the change from search rewind to normal Playback.

In the change from normal to search FF, since the reel motor and reel idler are already rotating in the forward direction, the pinch roller merely separates from the capstan shaft. At the same time, the tension band relaxes slightly and the reel motor speed increases.

However, when changing from S-FF to normal Playback, in the same manner as for the S-REW mode, the main solenoid and reel motor are briefly switched off, then the Play mode resumes.

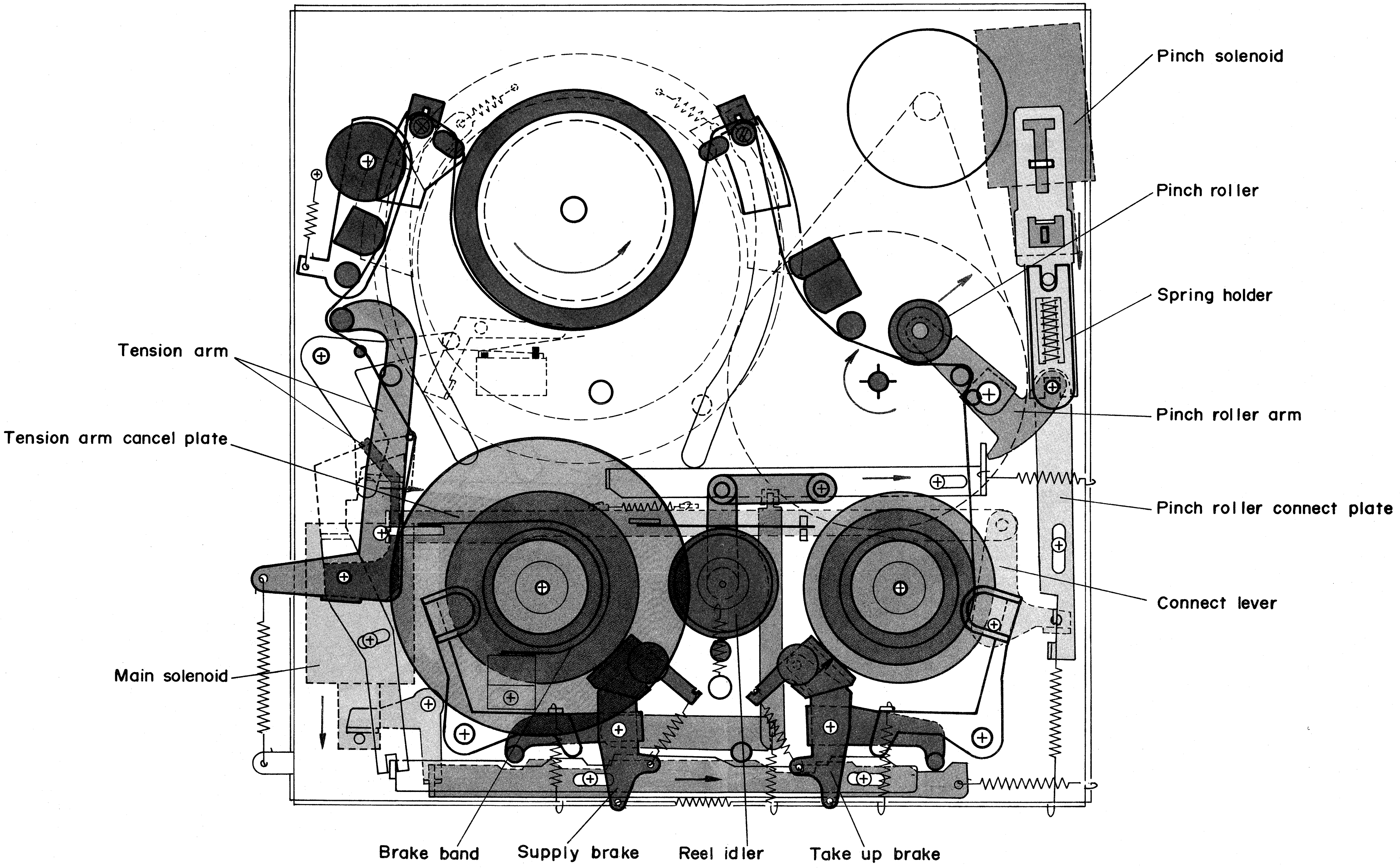

Pinch solenoid
Pinch roller
Spring holder
Tension arm
Tension arm cancel plate
Pinch roller arm
Pinch roller connect plate
Connect lever
Main solenoid
Brake band
Supply brake
Reel idler
Take up brake

Fig. 2-5 Pause mode mechanism

2.5 UNLOADING MODE

Pressing the STOP button in the Play/REC mode switches off the pinch solenoid and the pinch roller separates from the capstan. The main solenoid and reel motor switch off, and brakes are applied to both reel disks. At the same time, the reel idler separates from the take-up reel disk.

The main solenoid then switches on and the reel motor begins rotating in the rewind direction. At this time, the idler contacts the supply reel disk. The loading motor starts turning in the unloading direction and the loading rings rotate in the direction opposite of that during loading.

At the start of unloading, the AL switch is off and tension brake is applied to both reel disks. During unloading, the reel idler drives the supply reel disk and tape is rewound on the supply reel. Since take-up brake is not applied to the take-up reel disk, tape from the take-up reel is also rewound on the supply reel. Even tension is applied during unloading in order to protect the tape.

Toward the end of the unloading process, the UL switch is closed by pawl-A of the take- up loading ring. The loading, drum, capstan and reel motors stop, then the main solenoid switches off to produce the Stop mode.

Notes:

1. *The loading motor rotates in opposite directions during loading and unloading.*
2. *The pinch solenoid operates only when the AL switch is on. At this time, the pinch roller contacts the capstan shaft and supply back tension is applied.*

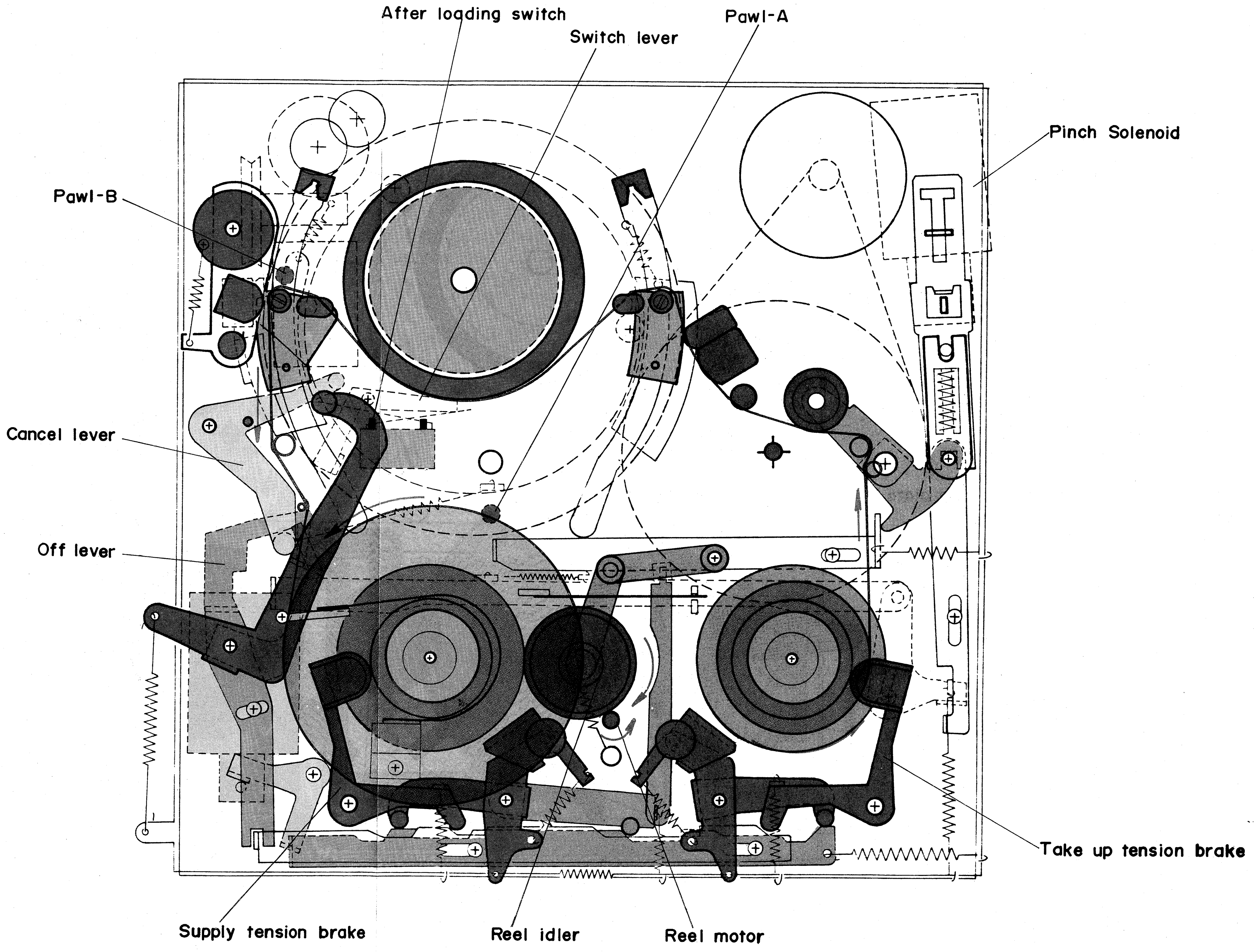


Fig. 2-6 Unloading mode mechanism

2-10

2.6 FAST FORWARD (FF) AND REWIND (REW) MODES

In these modes, the main solenoid is on and the main brake is released from both reel disks. According to the selected mode, the reel motor rotates in the forward (or rewind) direction and the reel idler contacts the take-up (or supply) reel disk. The reel motor continues to rotate and the tape becomes wound about the reel. At this time, tension braking is applied to both reel disks to prevent tape slackening.

Note:

Tension braking is applied to the reel disks in modes other than Play and Record. This prevents tape slackening and also serves to avoid residual slack when the main brake is applied to the reel disks.

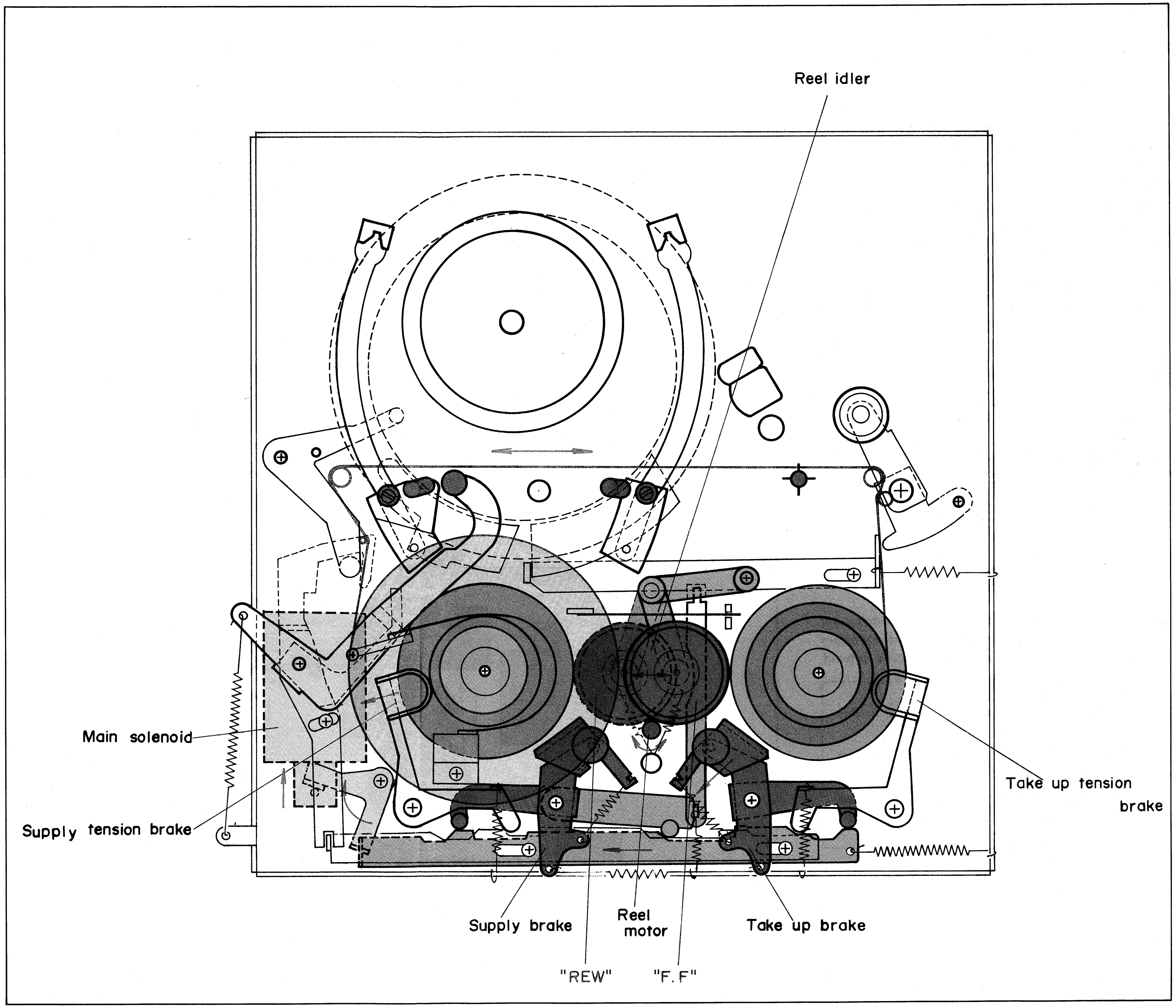

Reel idler
Main solenoid
Supply tension brake
Take up tension brake
Supply brake
Reel motor
Take up brake
"REW"
"F. F"

Fig. 2-7 F.F./REW mode mechanism

2.7 CASSETTE HOUSING

A motorized front loading system is used for the cassette housing which automatically performs loading and unloading of the cassette tape.

Fig. 2-8a indicates the state before a cassette is inserted. Inserting a cassette forces sprocket gear-2 and the roller upwards. This pulls the chain taut and the shutter blocks the cassette sensor. The cassette motor rotates in the loading direction for 5 seconds.

This rotation is transferred in the route: cassette belt → worm gear → relay gear → sprocket gear-1 → chain. The chain turns counter-clockwise. Sprocket gear-2 and the roller also turn counter-clockwise, and the cassette slides toward the right, as shown by Fig. 2-8b.

When the cassette is fully positioned, it presses the slide plate toward the right. The chain pin of the slide plate shifts toward the right and engages a link of the chain. As the chain rotates, the slide plate and housing are lowered by gears. This is illustrated in Fig. 2-9c.

After lowering into the chassis, the cassette switch becomes on, but the cassette motor continues to turn for another 300 msec. This compensates for possible switch timing error and ensures proper positioning of the housing. See Fig. 2-8d.

Pressing the EJECT button begins the unloading process, which starts after the stop state (UL switch on, main solenoid off, etc.) is reached. In the Eject mode, the cassette motor rotates in the unloading direction for 5 seconds, then switches off.

Note: *In the loading process, if the cassette switch is not on within 5 seconds after the cassette motor begins rotating, the Eject mode is automatically entered.*

Notes:

1. *Adjustment points have been reduced in this model due to the simplified mechanism.*
2. *Take-up and other rotational torque values are determined by voltages applied to the motors.*
3. *Since all mechanism functions are determined electrically, also refer to the electrical circuit descriptions of this manual.*

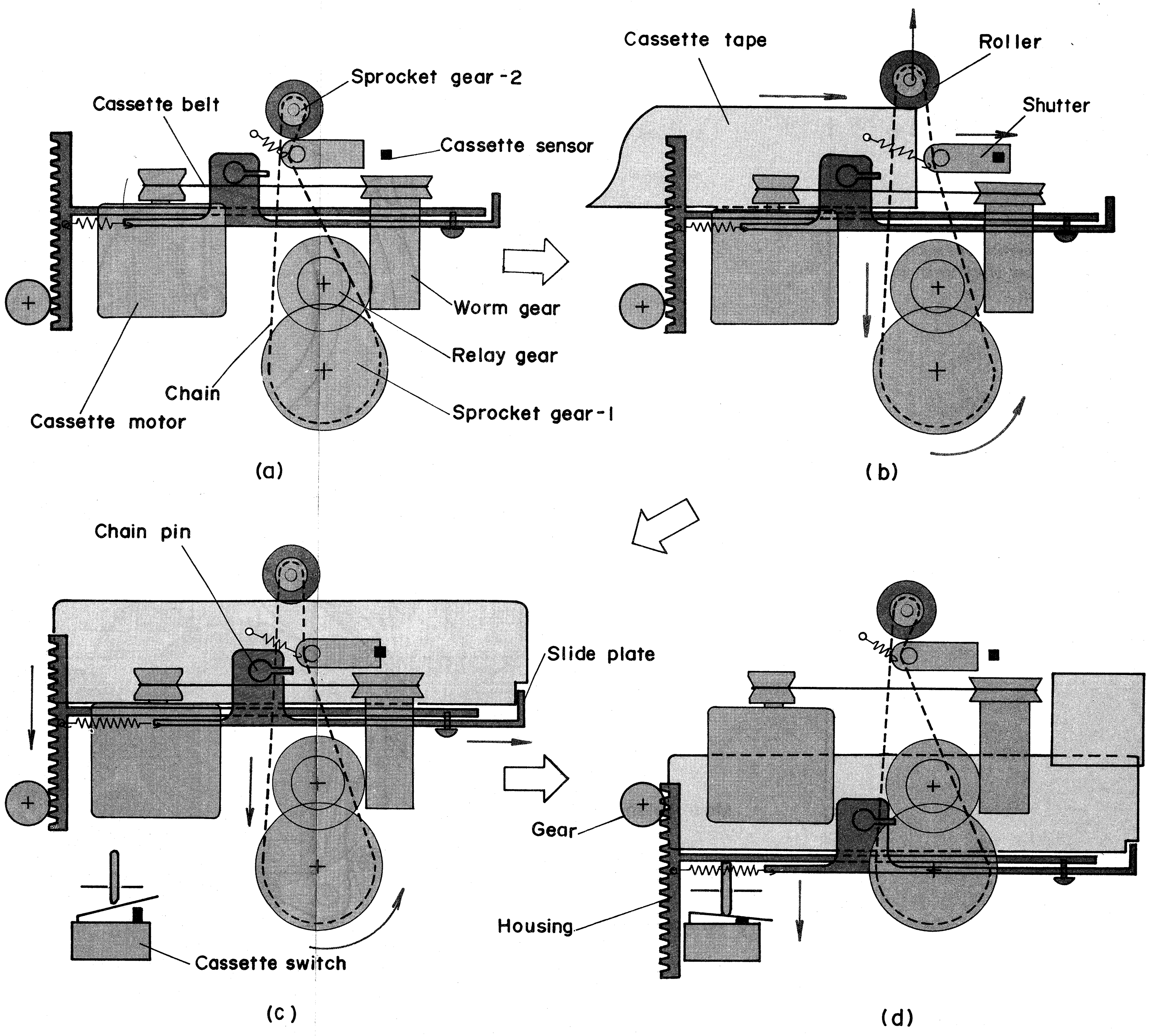


Fig. 2-8 Cassette housing heading mechanism

SECTION 3
CIRCUIT DESCRIPTION

3.1 NEW AND MODIFIED CIRCUITS

The following outline covers points which are new or modified with respect to earlier VHS models.

3.1.1 Video circuit

1. Video AGC
   A keyed type AGC (automatic gain control) circuit functions to maintain a fixed sync level.
   The circuit uses the type HA11701 IC and enhances picture stability during recording and playback. See the luminance signal recording system description (Section 3.1.5) for further information on this circuit.

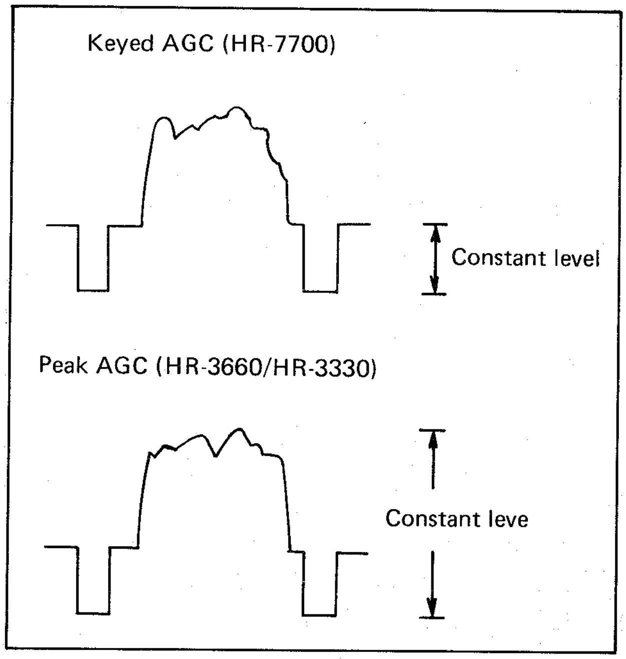


Fig. 3-1 Keyed AGC

2. Non-linear emphasis
   This is newly included with the pre-emphasis and double limiter circuits in order to improve signal to noise ratio (S/N) at low signal levels. The non-linear circuit functions to automatically adjust the amount of pre-emphases according to the input video signal level. Since noise is most apparent at low signal levels, the per-emphasis is increased, while it is reduced at higher signal levels.

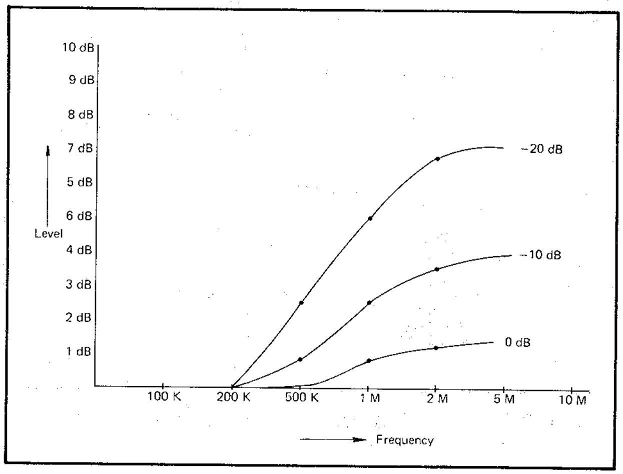


Fig. 3-2 Characteristics of non-linear emphasis

3. Color/BW mode selector
   Previous models in the VHS series included selectable filter circuits which allowed slightly higher horizontal resolution in the black & white mode (300 lines b/w; 250 line colour). In this model, only the colour circuit is employed and the separate b/w circuit has been omitted. Therefore, resolution in both colour and b/w modes is 250 lines. The input video signal goes through the AGC circuit, then to lowpass filter LPF-1 and equalizer EQ-1, which limits the video bandwidth. Frequencies above approx. 3.5 MHz are cutoff. The video signal is then ferquency modulated. Highpass filter HPF-1 determines the FM frequency band by passing signals above approx. 1.3 MHz and cutting those below this value.

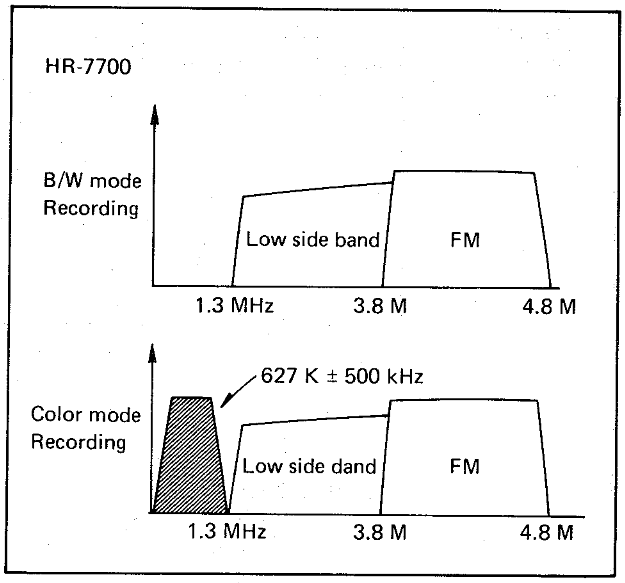


Fig. 3-3 HR-7700 Video recording characteristics

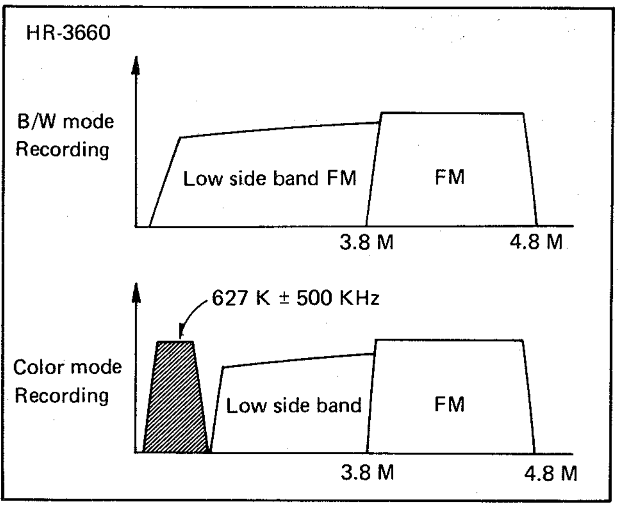


Fig. 3-4 HR-3660 Video recording characteristics

During playback, an LPF determines the high band frequency of the video signal. As noted above, the recording and playback luminance signal characteristics are the same for both colour and b/w modes.

4. Recording color killer
   A burst phase type colour killer is adopted using a special IC (HA11706). This improves colour killer operational stability with respect to input colour signal variations and S/N.

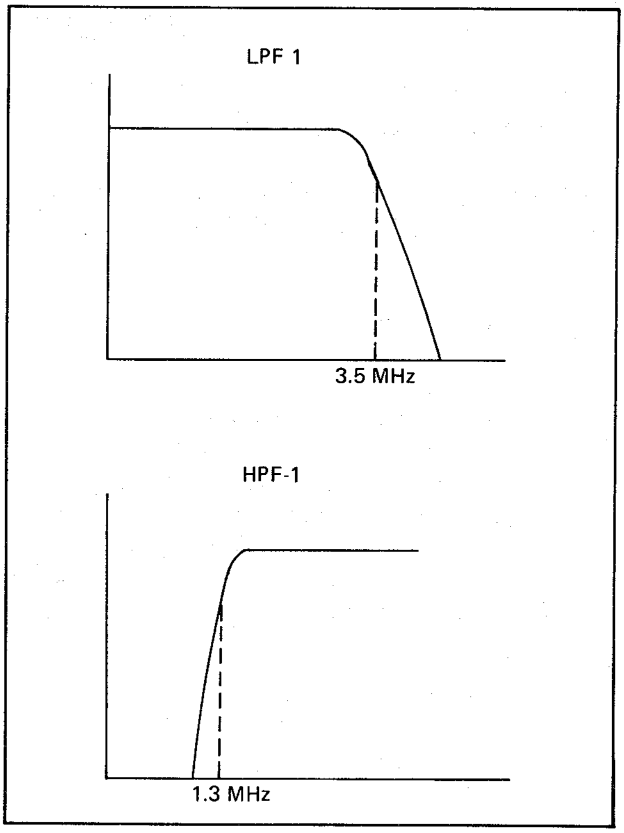


Fig. 3-5 Characteristics of LPF-1 and HPF-1

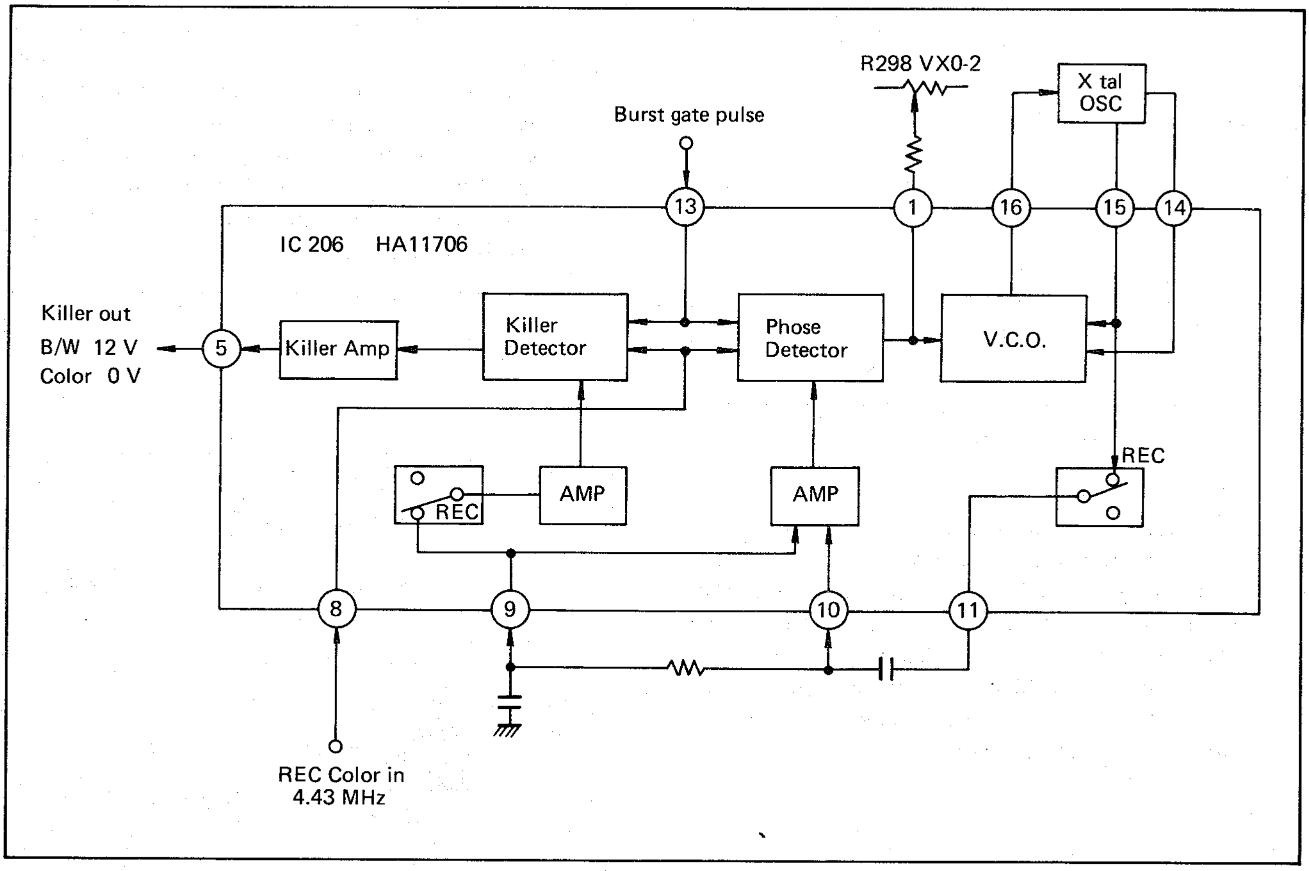

R298 VX0-2
X tal OSC
Burst gate pulse
13
1
16
15
14
IC 206 HA11706
Killer out
B/W 12 V
Color 0 V
5
Killer Amp
Killer Detector
Phase Detector
V.C.O.
REC
AMP
AMP
REC
8
9
10
11
REC Color in
4.43 MHz

Fig. 3-6 REC color killer circuit (HA11706)

The input colour signal at IC206 pin 8 goes to the phase detector of IC HA11706. A VCO (voltage controlled oscillator) produces a 4.43 MHz reference signal at pins 14, 15 and 16, which is supplied through a switch from pin 11. The phase of the 4.43 MHz reference signal is delayed 90°, after which it goes through a switching amplifier and via pin 9 to the colour killer detector.

The killer detector thus operates to compare the phases of the 4.43 MHz VCO reference signal and the burst component of the input colour signal.

5. SECAM detector (EG model only)
   A special IC is used for SECAM detection. This replaces the discrete components used in earlier circuits and features improved stability.

6. FM AGC
   An FM AGC circuit is included in the preamplifier IC (HA11718). This circuit holds the playback FM signal at a fixed level in order to improve the operating stability of the dropout compensator. See IC2 HA11718 description. (See Fig. 3-26).

7. Video input and output selection
   Video and audio input signals (camera, TV, line) and output selection are controlled electronically by IC2 and IC3 of the JUNCTION board. See Fig. 3-21.

8. Video system ICs
   The video system is largely contained in IC devices, simplifying circuit composition and contributing to servicing convenience. IC operations are shown in Fig. 3-7.

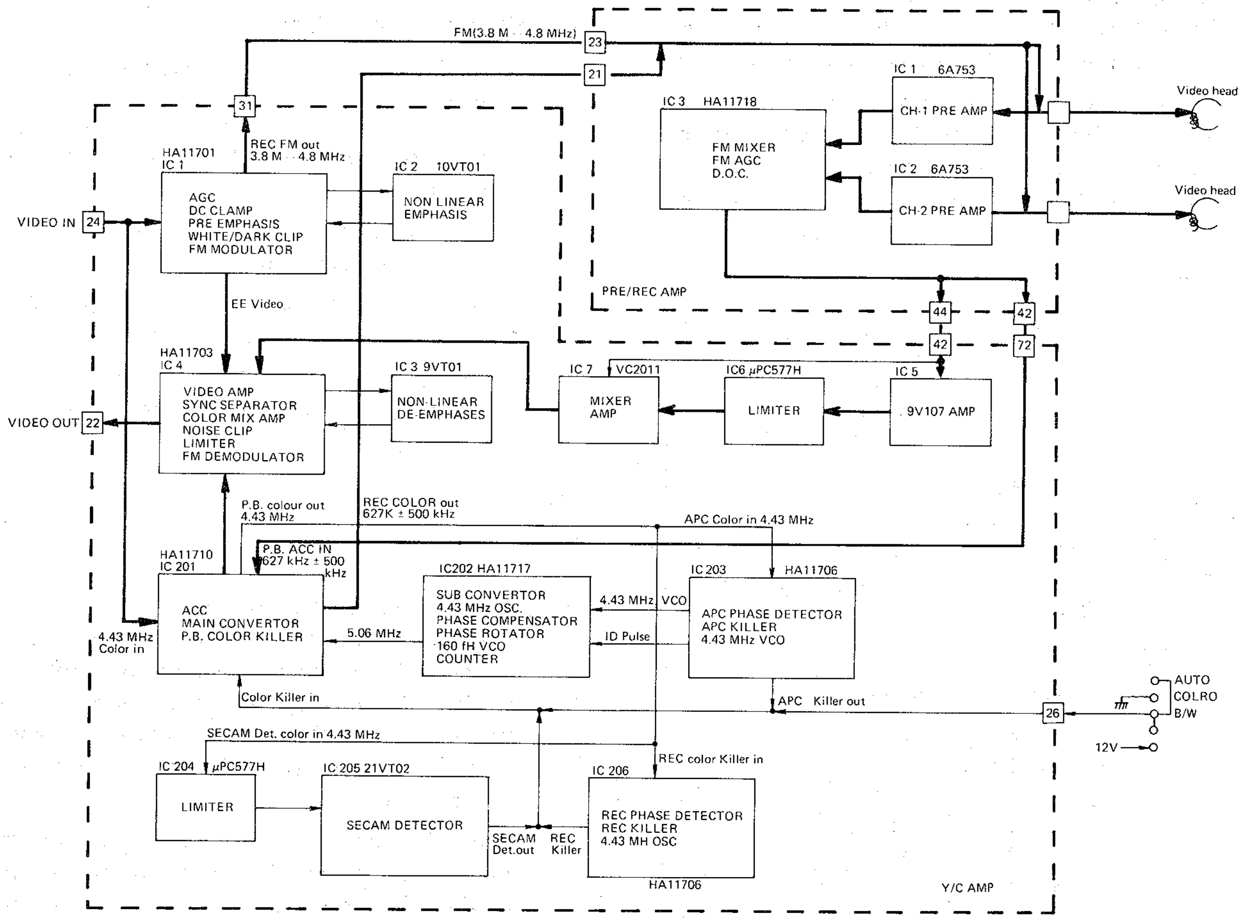

FM(3.8 M · 4.8 MHz)
23
21
31
REC FM out
3.8 M · 4.8 MHz
HA11701
IC 1
AGC
DC CLAMP
PRE EMPHASIS
WHITE/DARK CLIP
FM MODULATOR
IC 2 10VT01
NON LINEAR
EMPHASIS
VIDEO IN
24
EE Video
HA11703
IC 4
VIDEO AMP
SYNC SEPARATOR
COLOR MIX AMP
NOISE CLIP
LIMITER
FM DEMODULATOR
IC 3 9VT01
NON-LINEAR
DE-EMPHASES
VIDEO OUT
22
IC 3 HA11718
FM MIXER
FM AGC
D.O.C.
IC 1 6A753
CH-1 PRE AMP
IC 2 6A753
CH-2 PRE AMP
Video head
Video head
PRE/REC AMP
44
42
42
72
IC 7
VC2011
MIXER
AMP
IC6 μPC577H
LIMITER
IC 5
9V107 AMP
P.B. colour out
4.43 MHz
REC COLOR out
627K ± 500 kHz
APC Color in 4.43 MHz
HA11710
IC 201
P.B. ACC IN
627 kHz ± 500 kHz
ACC
MAIN CONVERTOR
P.B. COLOR KILLER
4.43 MHz
Color in
5.06 MHz
IC202 HA11717
SUB CONVERTOR
4.43 MHz OSC.
PHASE COMPENSATOR
PHASE ROTATOR
160 fH VCO
COUNTER
4.43 MHz
VCO
ID Pulse
IC 203
HA11706
APC PHASE DETECTOR
APC KILLER
4.43 MHz VCO
Color Killer in
APC Killer out
26
AUTO
COLRO
B/W
12V
SECAM Det. color in 4.43 MHz
REC color Killer in
IC 204
μPC577H
LIMITER
IC 205 21VT02
SECAM DETECTOR
SECAM
Det.out
REC
Killer
IC 206
REC PHASE DETECTOR
REC KILLER
4.43 MH OSC
HA11706
Y/C AMP

Fig. 3-7 Video system ICs

3.1.2 Audio circuit

1. Cue signal recording

   The cue signal is recorded on the tape and employed for cue stop functions. The cue signal recording circuit is included in the audio circuit system.

   1) The cue signal is a 30 Hz squarewave.
   2) It is recorded by the full erase head and played back by the cue head.
   3) The cue signal is recorded for one second after the start of full recording.
   4) It is recorded full track on the tape.
   5) The signla is played back by the cue head only during fast forward and rewind modes.

   AUDIO board X14, X15, X20 and IC3 form the recording cue circuit. For a one second period at the start of recording, the $\overline{\text{CUE SET}}$ output from the mechacon circuit switches X20 on, supplying unregulated 20 V to IC3 pin 7. A 30 Hz squarewave from IC3 pin 6 goes to the bases of X14 and X15, then to Relay-1 NO (normal open) terminals.

   During the $\overline{\text{CUE SET}}$ output, 13 conducts and relay-1 switches on. The 30 Hz output from the full erase head is then recorded on the tape as the cue signal. Refer to the mechacon circuit decription regarding the cue playback circuit.

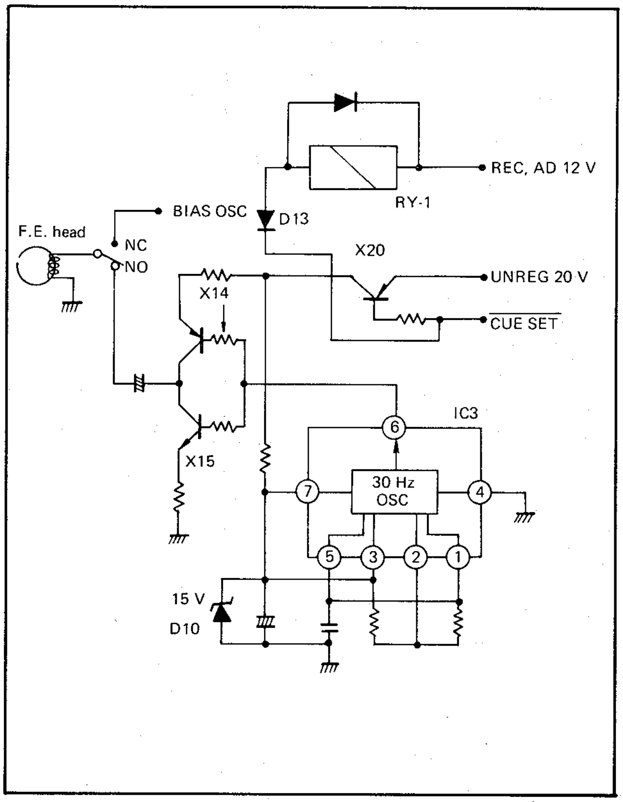


Fig. 3-8 Cue signal recording circuit

2. Dolby circuit

   Dolby noise reduction has been added to the audio circuit for improved S/N. Generally, audio noise is most objectionable in tape recording systems in the high frequency portions of the signal. Assume for example, that the amount of noise generated internally by a tape recording/playback system is fixed. Because of the characteristics of magnetic tape and magnetic heads, high frequencies tend to be recorded at a lower level than the main portion of the signal. Thus, the difference between the noise level and the signal, level becomes reduced at high frequencies, making the noise more noticeable to the ear. In the Dolby noise reduction system, high frequencies are selectively enhanced prior to recording (producing a greater difference between signal and noise). During playback, the enhanced portion of the signal is reduced to resume its normal relationship with the rest of the signal. In this manner, since the signal passes through the magnetic and electronic sections of the machine at a selectively higher level, it is less affected by internally generated noise.

   Important points to note about noise reduction systems are:

   1) They must be used both during recording and playback.
   2) Only noise generated in the record/playback system is effectively reduced.
   3) They cannot appreciably reduce noise which is contained in the original signal or which has actually been recorded on the tape.

   The Dolby circuit is contained in IC9 (LM1011N).

3.1.3 Servo system

1. Direct drive (DD) drum motor

   The video head drum is driven directly by a Hall element DC motor which features high rotational stability. Among other advantages of a DC motor are independence from the power source frequency and a relatively large drive torque from a small drive current.

   With a DC motor, the direction of the stator drive current must be switched according to the rotor position. Traditionally, this switching has been performed mechanically, leading to occasional problems of long term durability. In order to perform the switching electrically, some means is required for detection teh magnetic pole positions of the totor.

Two Hall elements are used in this model for detecting the rotor pole positions. The resulting DC motor is therefore brushless and offers prolonged reliability.

*Hall element

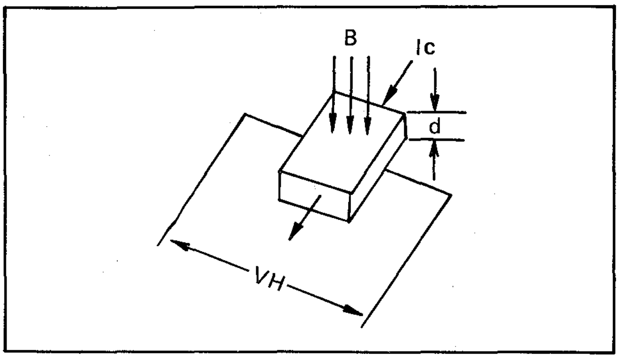


Fig. 3-9 Hall element

This is a type of semiconductor which utilizes the Hall effect. As illustrated in Fig. 3-9, when control current IC flows through a conductor and magnetic flux B is applied perpendicularly, voltage VH becomes produced perpendicularly (3-dimensionally) to both IC and B. This relationship can be expressed by the formula:

$$V_H = R_H \times \frac{I_C \times B}{d}$$

In the above, R_H = material constant (Hall coefficient)
d = conductor thickness

The Hall elements function to detect the relative positions of the rotor poles and stator coils. As shown in Fig. 3-10, two Hall elements (HG-1 and HG-2) are mounted to the stator. Coils 1 and 2 form the stator, while magnets are located in the outer rotor. When a rotor N (north) pole is adjacent to HG-1, a negative output voltage appears at the right terminal and a positive voltage at the left terminal. Low base potential cuts off transistors X22 and X25. The high potential output of the Hall element switches on transistors X21 and X26. X18 is switched on and X17 off. When X18 is on, X29 switches on to apply low

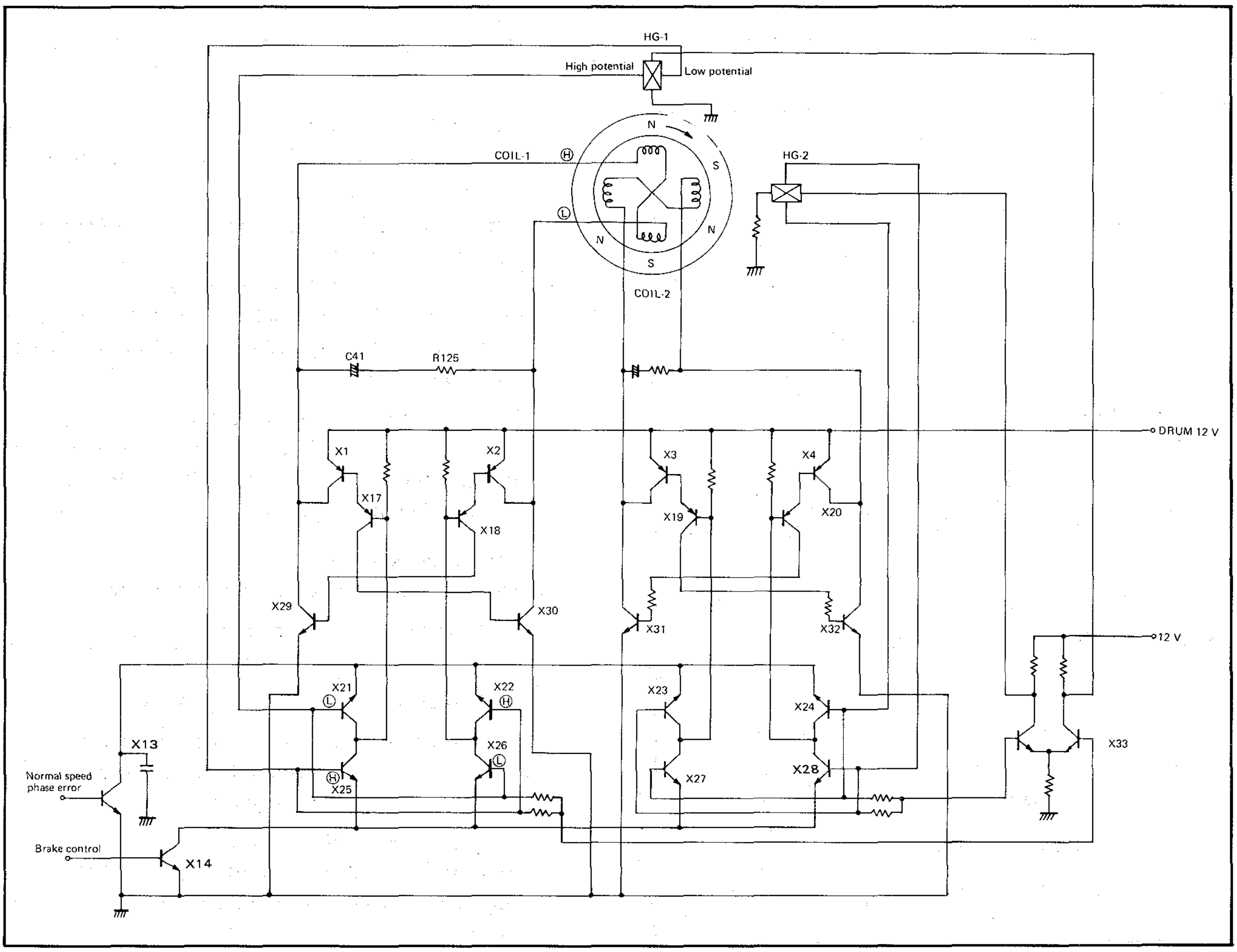

HG-1
High potential
Low potential
N
S
N
S
N
COIL-1
Ⓗ
Ⓛ
HG-2
COIL-2
C41
R125
DRUM 12 V
X1
X2
X3
X4
X17
X18
X19
X20
X29
X30
X31
X32
12 V
X21
Ⓛ
X22
Ⓗ
X23
X24
X26
Ⓛ
X28
X33
X13
Normal speed phase error
Ⓗ
X25
X27
Brake control
X14

Fig. 3-10 Drum motor drive

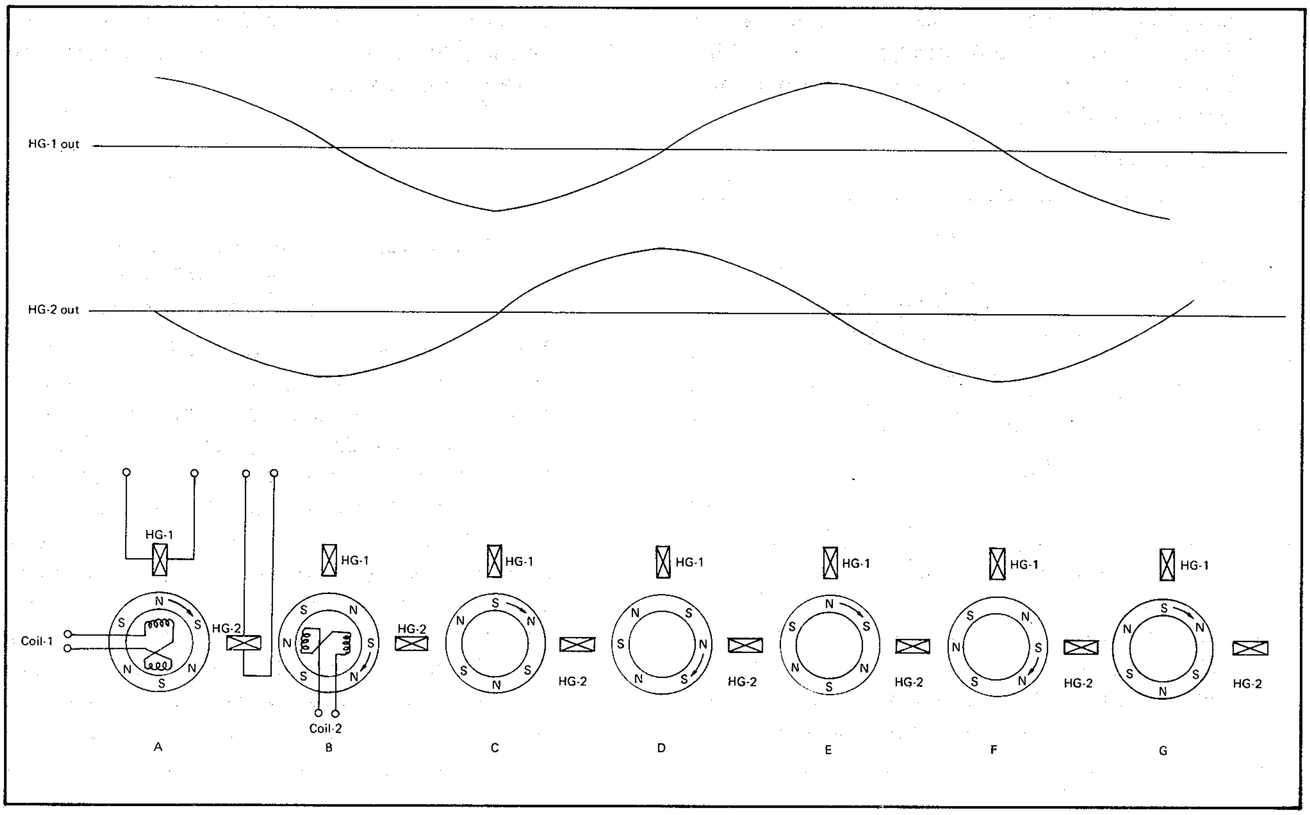


Fig. 3-11

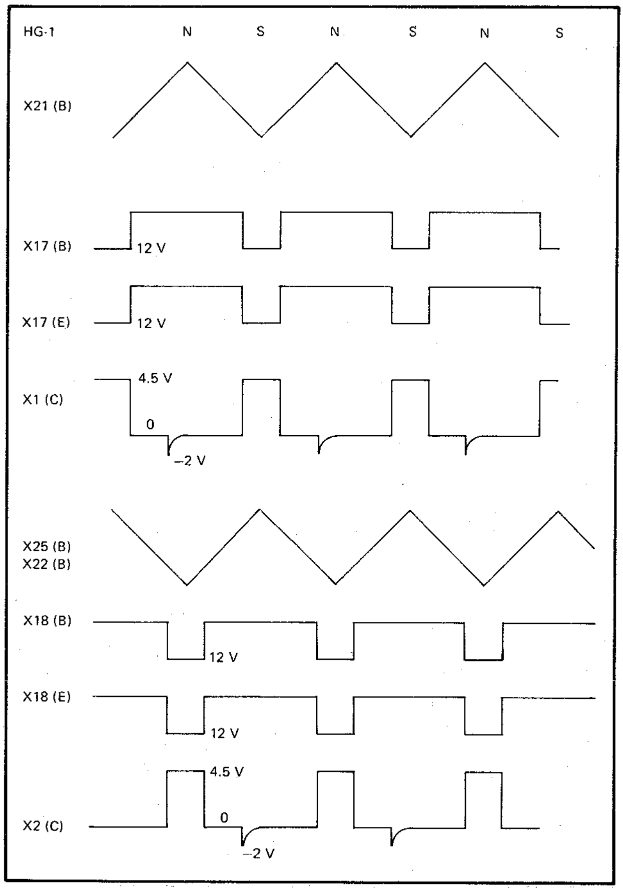


Fig. 3-12 Drum motor circuit timing chart

potential to one side of stator coil-1. X2 switches on to apply drum 12 V to coil-1 and the rotor turning.

After rotating 30°, the S (south) pole of the rotor becomes adjacent to HG-2. High base potential switches X23 and X28 on, while X24 and X27 switch off. At this point, X20, X4 and X31 switch on, supplying current to coil-2 and th rotor continues turning.

In this manner, sequential switching is performed and the rotor turns in one direction. Phase control voltage applied to the bases of X13 and X14 controls the Hall motor rotation.

3. Three servo system
Three servo circuits are used in this machine.

Drum servo	: Controls video video head rotation
Capstan servo	: Regulates tape speed
Reel servo	: Controls idler rotation to regulate take-up and supply reel rotation

The drum and capstan servos are essentially the same as those of other models in the VHS series, however, the reel servo system has been newly added.

MODE	DRUM SERVO		CAPSTAN SERVO		REEL SERVO
	Reference signal	Comparison Signal	Reference Sigmal	Comparison Signal	
REC	VIDEO SYNC (25Hz)	DRUM PULSE (25Hz)	VIDEO SYNC (25Hz)	Cspstan FG $\frac{225}{9}$=25 Hz	Fixed Potential from Mecha-Con
PLAY and SPEED	X TAL (25 Hz)	DRUM PULSE (25 Hz)	X TAL (25 Hz)	CTL PULSE (25 Hz)	
EDIT	VIDEO SYNC (25 Hz)	DRUM PULSE (25 Hz)	VIDEO SYNC (25 Hz)	CTL PULSE ↯ FG 25Hz	
STILL SLOW FRAME ADV.	X TAL (25 Hz)	DRUM PULSE (25 Hz)	Pulse drive by BA841.		
SHUTTLE SEARCH FF/REW	Discriminator Loop S-FF S-REW		FREE RUN		Control Pulse tape Speed Control X10 Speed.
REW/FF	STOP		STOP		Discriminator control from Mecha-con.

Table-1 Servo control signal

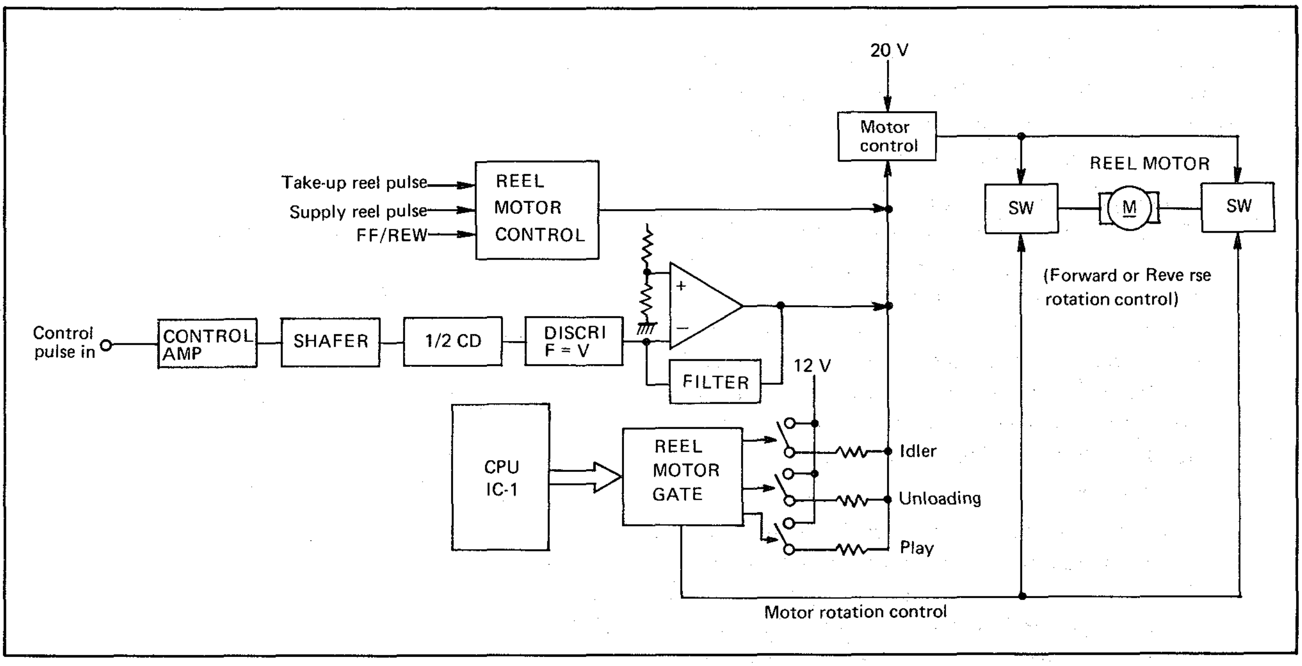

20 V
Motor control
REEL MOTOR
SW
M
SW
(Forward or Reve rse rotation control)
Take-up reel pulse
Supply reel pulse
FF/REW
REEL MOTOR CONTROL
+
−
Control pulse in
CONTROL AMP
SHAFER
1/2 CD
DISCRI F = V
FILTER
12 V
CPU IC-1
REEL MOTOR GATE
Idler
Unloading
Play
Motor rotation control

Fig. 3-13 Reel motor drive circuit

The reel servo performs the following functions.

1) Rotational control by regulated voltage (mechacon circuit) : idler, unloading and play modes.
2) Control of rotational voltage using reel pulse (mechacon circuit) : rewind and fast forward modes.
3) Rotation control from reel servo circuit (servo circuit) : search-FF and search-REW modes.

Reel servo operating principle.

As illustrated in Fig. 3-13, the reel motor control system consists basically of three lines. The following outline pertains to the 10 X search modes, in which speed is controlled by the servo circuit. Refer to the mechacon circuit description regarding the fixed speed, rewind and fast forward control functions.

The reel servo circuit detects the control pulse frequency during search, FF and REW moses, and controls reel rotation for approximately 10 times normal speed. In search-FF and search-REW modes, the control pulse is amplified and applied to a Schmitt trigger circuit. The resulting waveform is divided to 1/2 frequency to become a 125 Hz signal. This process can be expressed simply as follows.

25 Hz control pulse x 10 (search speed) = 250 Hz
This is divided by 2 to yield 125 Hz.

The discriminator circuit converts the control pulse frequency difference into a DC voltage difference. This DC voltage is applied to the reel motor through an amplifier and filter.

4. Shuttle search (S-FF and S-REW)
In the shuttle search mode, playback is performed while the tape runs at fast forward and rewind speeds. During this time, the speeded up picture can be viewed on a TV-monitor.

1) FM output and tape pattern
Fig. 3-14 shows the relationship between the tape pattern and playback heads during play at approx. 10 times normal speed in forward and reverse directions. Each of the two playback heads traces 10 recorded tracks. However, due to the ±6° azimuth angle, an FM output is obtained only when each head traces its corresponding channel. Thus, each head effectively traces 5 tracks.

Since the playback scanning angle of the heads differs greatly from that during recording, the FM output becomes a diamond shaped waveform as shown in Fig. 3-14. In the playback picture, noise appears at the junctures between tracks.

2) Relative speed compensation
The tape speed during shuttle search is approximately 10 times that of normal speed. This introsuces a change in relative speed between the video tape and video heads. During search-FF, the tape and heads move in the same direction, leading to a delay in relative speed.
Conversely, the movements are opposite during search-REW. Thus, the effects on the playback signal become:

Search FF : relative speed delayed
(approx. −5%);
sync frequency reduced
Search REW:increased relative speed
(approx. +6%);
sync frequency increased

In order to improve stability in the picture display on the TV-monitor, compensation for the relative speed differences is required. This is performed by increasing the head rotation by about 5% during search-FF and delaying it by about 6% during search-REW as shown in Fig. 3-15.

As in the cases of the slow and still modes, a vertical pulse is inserted in the playback signal to reduce jitter in the TV-monitor display caused by noise interference with the TV vertical sync.

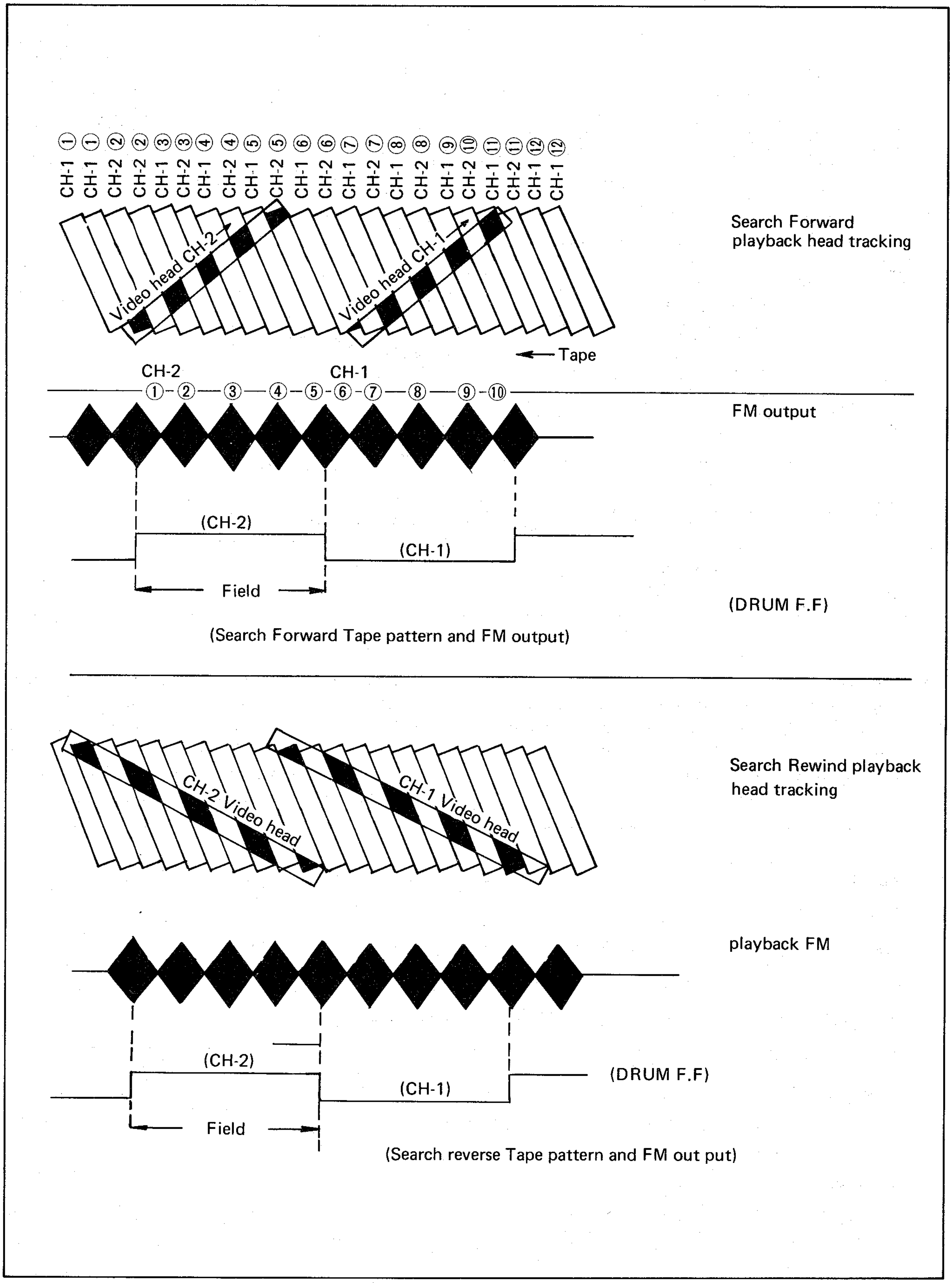

CH-1 ①
CH-1 ①
CH-2 ②
CH-2 ②
CH-1 ③
CH-2 ③
CH-1 ④
CH-2 ④
CH-1 ⑤
CH-2 ⑤
CH-1 ⑥
CH-2 ⑥
CH-1 ⑦
CH-2 ⑦
CH-1 ⑧
CH-2 ⑧
CH-1 ⑨
CH-2 ⑩
CH-1 ⑪
CH-2 ⑪
CH-1 ⑫
CH-1 ⑫
Video head CH-2
Video head CH-1
Search Forward playback head tracking
Tape
CH-2
CH-1
①-②-③-④-⑤-⑥-⑦-⑧-⑨-⑩
FM output
(CH-2)
(CH-1)
Field
(DRUM F.F)
(Search Forward Tape pattern and FM output)
CH-2 Video head
CH-1 Video head
Search Rewind playback head tracking
playback FM
(CH-2)
(CH-1)
(DRUM F.F)
Field
(Search reverse Tape pattern and FM out put)

Fig. 3-14 Shuttle search

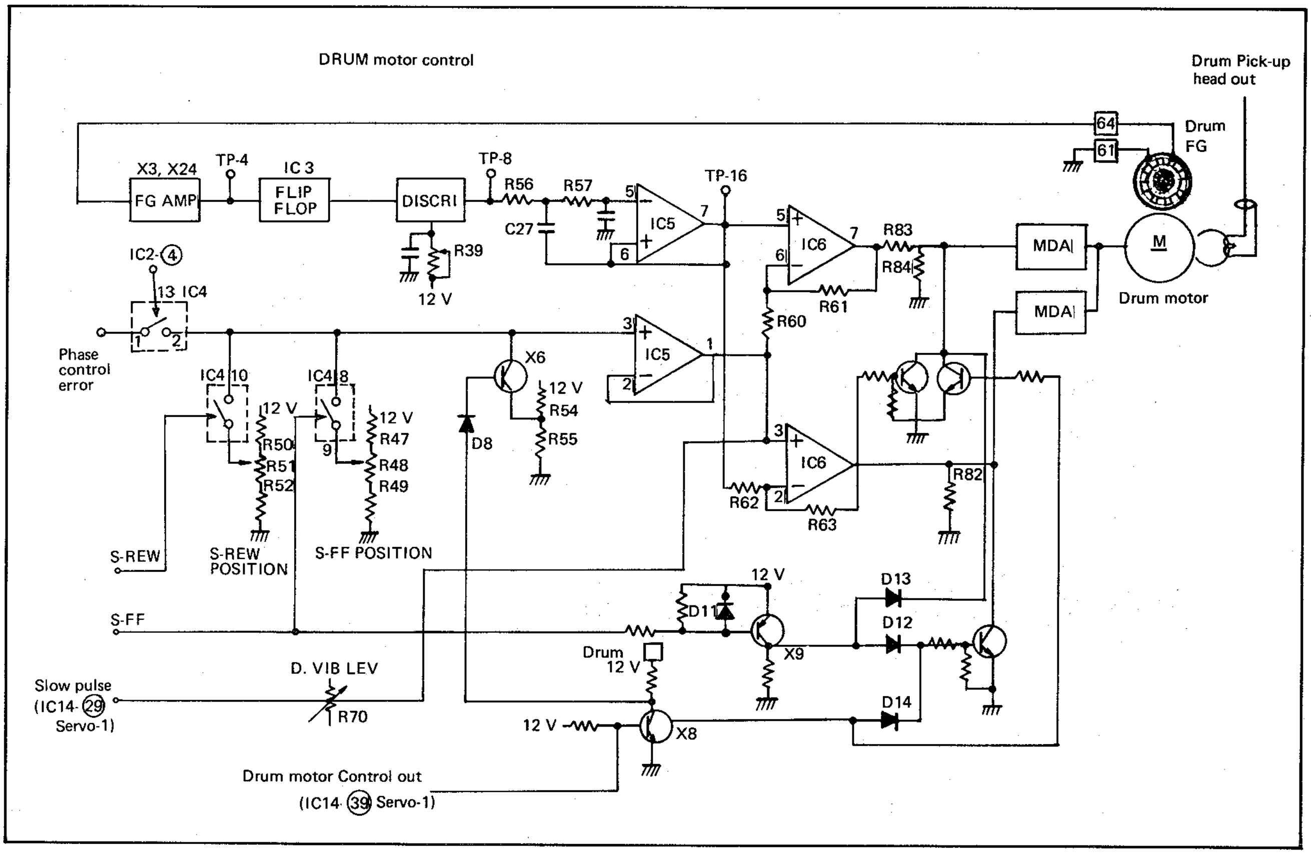

DRUM motor control
Drum Pick-up head out
64
61
Drum FG
X3, X24
TP-4
IC 3
TP-8
FG AMP
FLIP FLOP
DISCRI
R56
R57
C27
R39
12 V
TP-16
IC5
IC6
R83
R84
R61
R60
MDAI
MDAI
M
Drum motor
IC2-④
13 IC4
Phase control error
IC4 10
IC4 8
9
12 V
R50
R51
R52
R47
R48
R49
X6
R54
R55
D8
R62
R63
R82
S-REW
S-REW POSITION
S-FF POSITION
S-FF
D11
D13
D12
D14
X9
Drum 12 V
X8
D. VIB LEV
R70
Slow pulse (IC14-㉙ Servo-1)
Drum motor Control out (IC14-㊴ Servo-1)

Fig. 3-15 Drum motor speed control circuit

5. Frame advance

The frame advance operation is controlled by IC14 (BA841) of the servo circuit. In this IC, monostable multivibrator MM-4 controls slow speed and MM-5 controls frame advance. Slow speed is determined by the time constant of MM-4, while the MM-5 time constant at IC14 pin 20 determines the frame advance time. This time constant is about 1.5 seconds. By holding the FR ADV key depressed, the picture advances one TV frame at a time at intervals of 1.5 seconds.

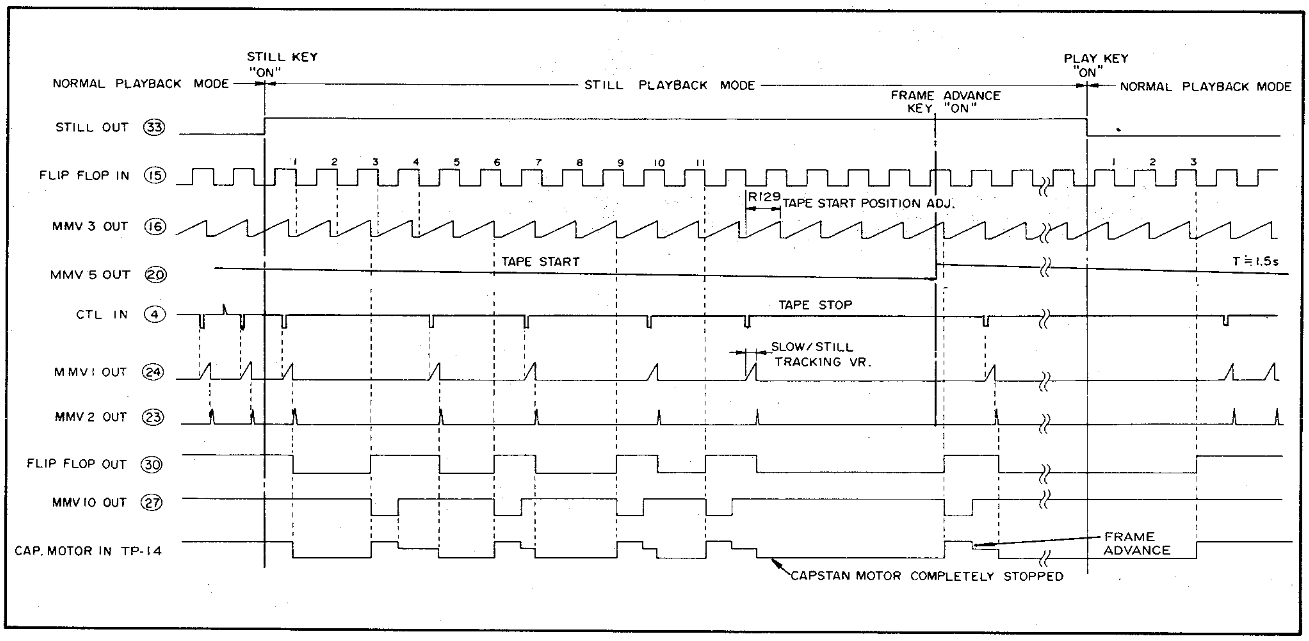

STILL KEY "ON"
PLAY KEY "ON"
NORMAL PLAYBACK MODE
STILL PLAYBACK MODE
FRAME ADVANCE KEY "ON"
NORMAL PLAYBACK MODE
STILL OUT ㉝
FLIP FLOP IN ⑮
MMV 3 OUT ⑯
MMV 5 OUT ⑳
CTL IN ④
MMV 1 OUT ㉔
MMV 2 OUT ㉓
FLIP FLOP OUT ㉚
MMV 10 OUT ㉗
CAP. MOTOR IN TP-14
1 2 3 4 5 6 7 8 9 10 11
1 2 3
R129 TAPE START POSITION ADJ.
TAPE START
T ≒ 1.5s
TAPE STOP
SLOW/STILL TRACKING VR.
FRAME ADVANCE
CAPSTAN MOTOR COMPLETELY STOPPED

Fig. 3-16 Frame advance timing chart

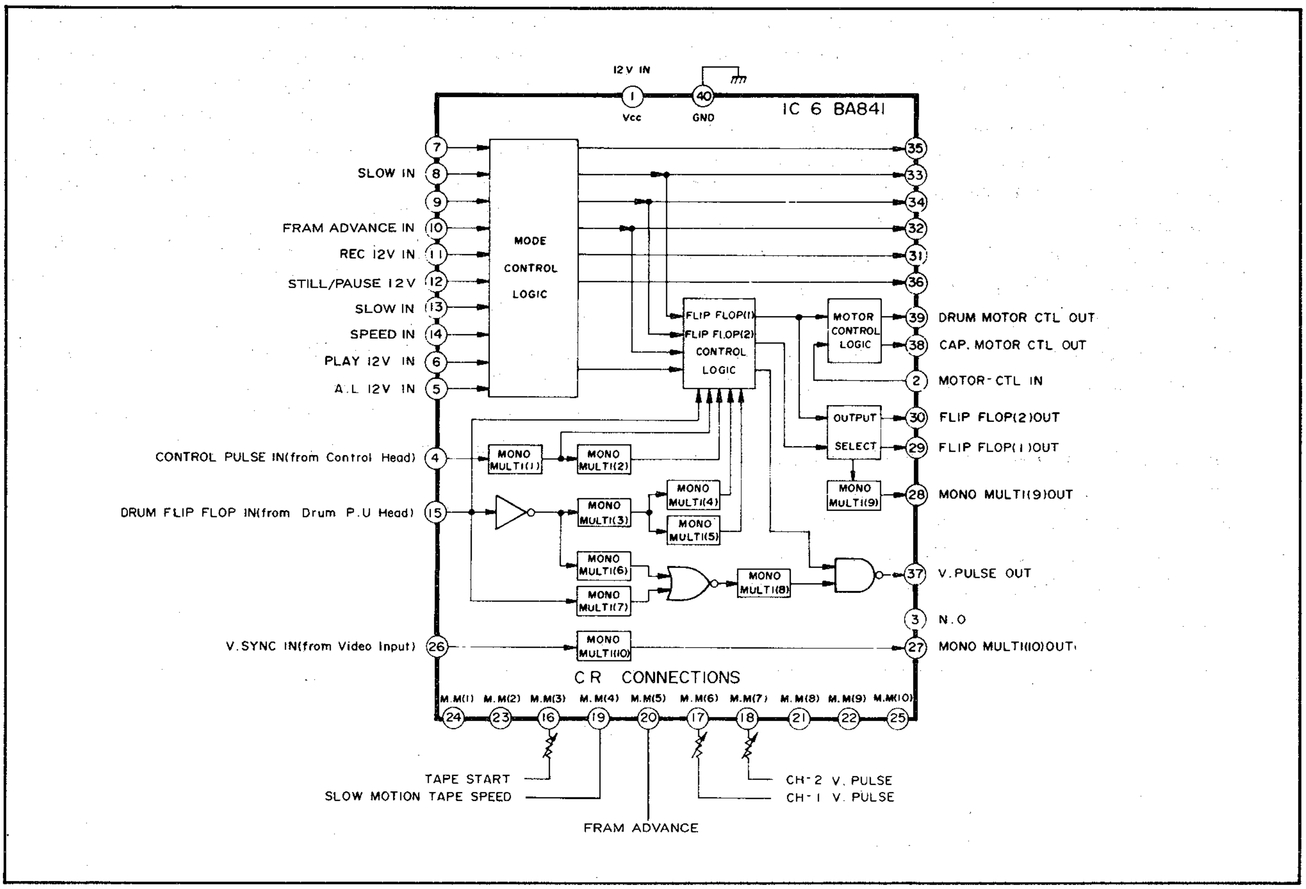

12V IN
Vcc
GND
IC 6 BA841
SLOW IN
FRAM ADVANCE IN
REC 12V IN
STILL/PAUSE 12V
SLOW IN
SPEED IN
PLAY 12V IN
A.L 12V IN
MODE CONTROL LOGIC
FLIP FLOP(1)
FLIP FLOP(2)
CONTROL LOGIC
MOTOR CONTROL LOGIC
DRUM MOTOR CTL OUT
CAP. MOTOR CTL OUT
MOTOR-CTL IN
OUTPUT SELECT
FLIP FLOP(2)OUT
FLIP FLOP(1)OUT
CONTROL PULSE IN(from Control Head)
MONO MULTI(1)
MONO MULTI(2)
DRUM FLIP FLOP IN(from Drum P.U Head)
MONO MULTI(3)
MONO MULTI(4)
MONO MULTI(5)
MONO MULTI(9)
MONO MULTI(9)OUT
MONO MULTI(6)
MONO MULTI(7)
MONO MULTI(8)
V.PULSE OUT
N.O
V.SYNC IN(from Video Input)
MONO MULTI(10)
MONO MULTI(10)OUT
C R CONNECTIONS
M.M(1) M.M(2) M.M(3) M.M(4) M.M(5) M.M(6) M.M(7) M.M(8) M.M(9) M.M(10)
TAPE START
SLOW MOTION TAPE SPEED
FRAM ADVANCE
CH-2 V. PULSE
CH-1 V. PULSE
1 40 7 8 9 10 11 12 13 14 6 5 4 15 26
35 33 34 32 31 36 39 38 2 30 29 28 37 3 27
24 23 16 19 20 17 18 21 22 25

Fig. 3-17 BA841

When the FR ADV key is pressed, then released, X17 at pin 20 switches on, discharging the pin 20 voltage. MM-5 operates and the motor turns to transport one frame.

3.1.4 Mechanism contorl circuit

1. Tuner/timer control circuit
   Since the mechacon and tuner/timer control circuits are newly designed, refer to the respective circuit descriptions.
2. Tape remaining detector CPU
   Microcomputer IC2 (μPD554C-036) of the mechacon circuit functions as the tape remaining detector. Input detector signals of IC2 are X2, play, search, FF, REW, cassette switch, cassette presence, take-up reel pulse and supply reel pulse. See Fig. 3-18.

   Each reel disk assembly includes a 48 toothed gear and photo sensor, which produce 48 pulses per rotation.

   At initial reset, the tape remaining LEDs are switched off. Also, if the play mode is already in progress, and the FF, REW, search or eject mode selected, the reset operation clears the display data.

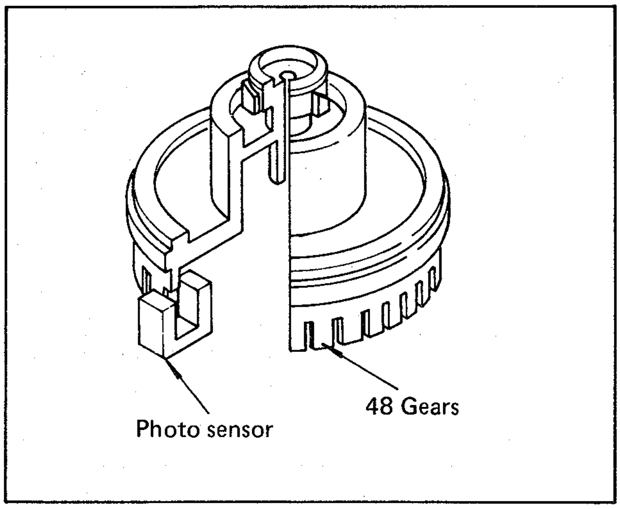


Photo sensor
48 Gears

Fig. 3-18 Take-up and supply reel disk

After clearing the tape data, cassette presence and operating mode are detected. If play mode, still, slow, then normal and speed playback are polled. During normal playback, the times required for one rotation of the supply and take-up reel disks are measured (two rotations are measured during speed playback). The total tape length of the cassette is detected by taking the sum of these rotating times. The tape is classified according to whether this sum is greater of less than 16.5 seconds. The relationship between tape length and reel rotation is shown in the graph.

For example, at the beginning of E-180 tape in the play mode, since the winding radius of the take-up reel is small, one rotation requires about 3.5 seconds (point X). In the case of the supply reel, the winding radius is large and one rotation requires about 11.4 seconds (point Y). The sum of the two disk rotations becomes approximately 14.9 seconds. Since this is less than 16.5 seconds, the microcomputer interperts the presence of E-180 tape.

Similarly, in the case of an E-90 cassette, at the start of normal playback, the take-up reel disk turns once in about 8.3 seconds and the supply reel disk in 11.4 seconds. By the resulting sum of 19.7 seconds, the microcomputer interprets the presence of an E-90 cassette.

After detecting the cassette type, tape remaining detection is performed by comparing the time required for one or two rotations of the supply reel disk with data stored in the microcomputer memory. Point I in the graph corresponds to the midpoint of E-180 tape, at which time the μcom output data indicate 90 minutes of tape remaining. Similarly, in the case of E-90 tape, the rotation time of the supply reel disk is measured from point i.

The 5 bit parallel data from the IC2 μcom are obtained from TP0 to TP4. The correspondence between the output data and the tape remaining LED display is indicated in Fig. 3-20

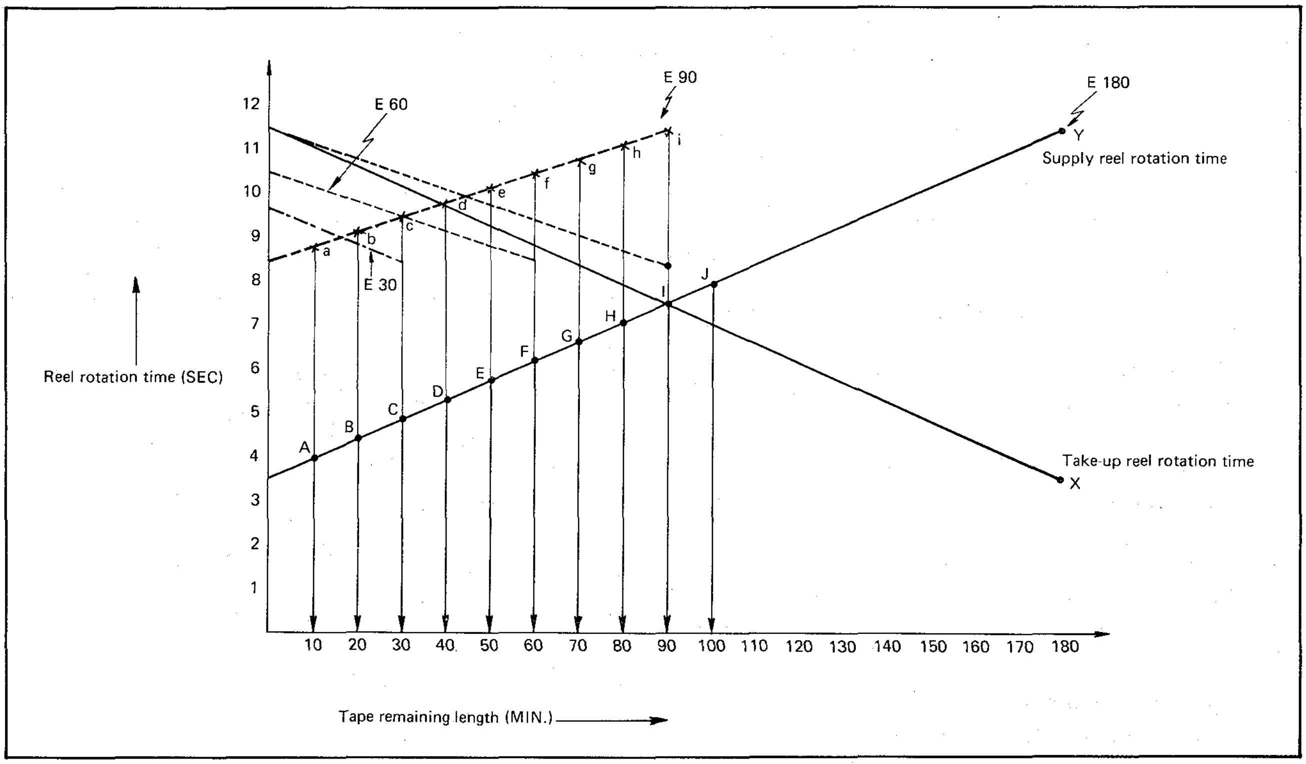
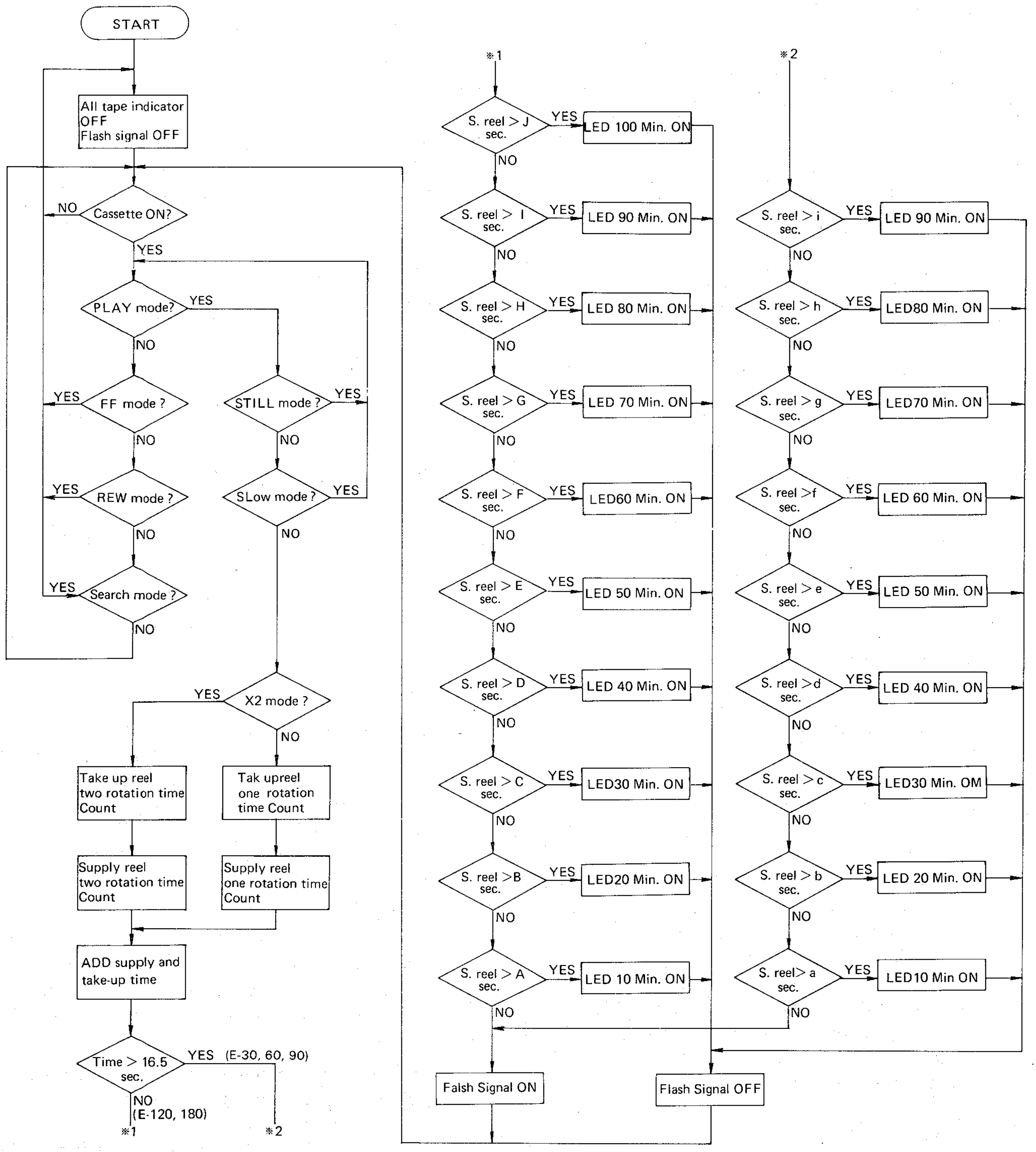
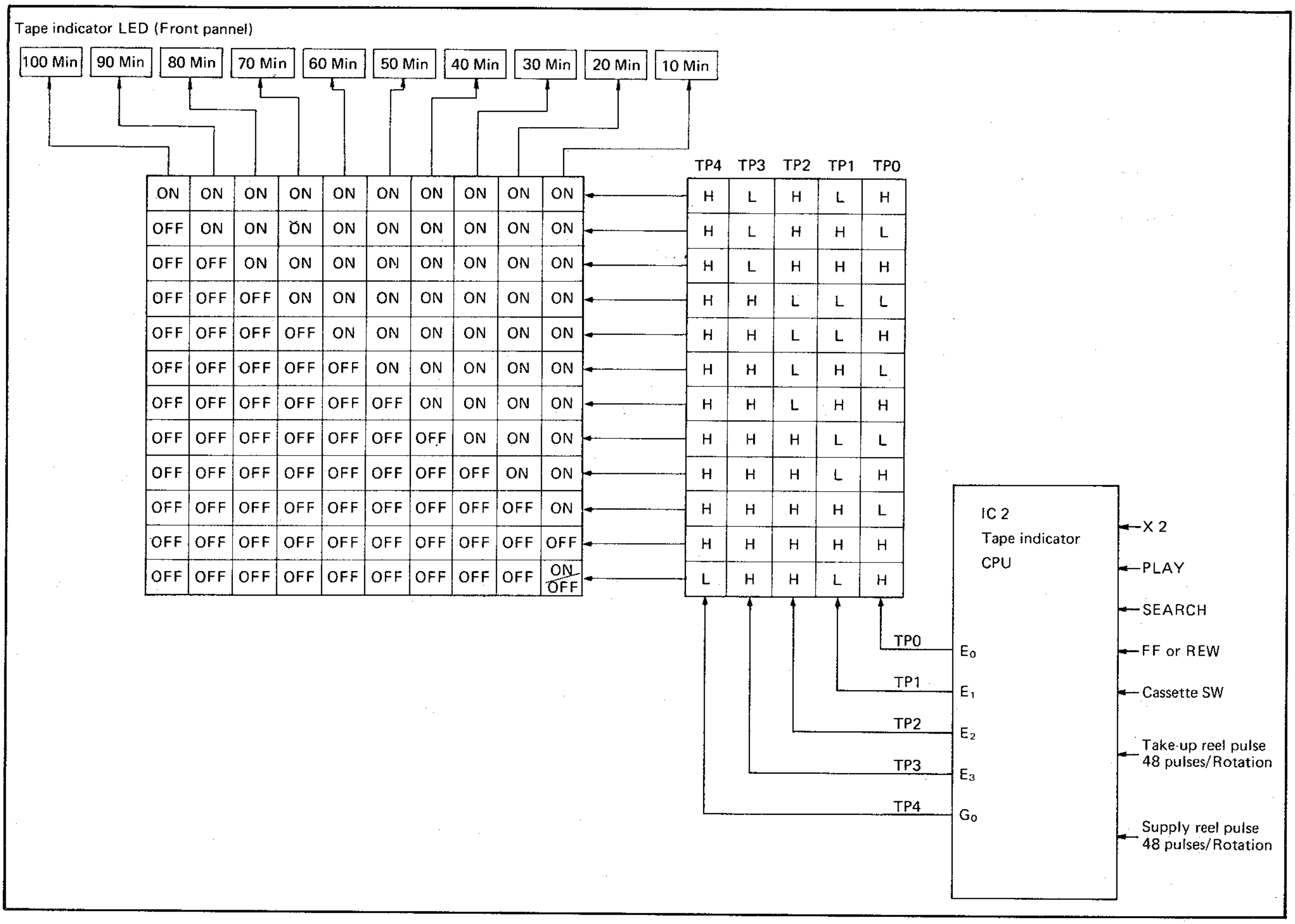


Fig. 3-19 Tape remaining indicator

Flowchart for tape remaining indicator


START
All tape indicator OFF
Flash signal OFF
Cassette ON?
NO
YES
PLAY mode?
YES
NO
FF mode ?
YES
NO
REW mode ?
YES
NO
Search mode ?
YES
NO
STILL mode ?
YES
NO
SLow mode ?
YES
NO
X2 mode ?
YES
NO
Take up reel two rotation time Count
Tak upreel one rotation time Count
Supply reel two rotation time Count
Supply reel one rotation time Count
ADD supply and take-up time
Time > 16.5 sec.
YES (E-30, 60, 90)
NO (E-120, 180)
※1
※2
※1
S. reel > J sec.
LED 100 Min. ON
S. reel > I sec.
LED 90 Min. ON
S. reel > H sec.
LED 80 Min. ON
S. reel > G sec.
LED 70 Min. ON
S. reel > F sec.
LED60 Min. ON
S. reel > E sec.
LED 50 Min. ON
S. reel > D sec.
LED 40 Min. ON
S. reel > C sec.
LED30 Min. ON
S. reel >B sec.
LED20 Min. ON
S. reel > A sec.
LED 10 Min. ON
Falsh Signal ON
Flash Signal OFF
※2
S. reel > i sec.
LED 90 Min. ON
S. reel > h sec.
LED80 Min. ON
S. reel > g sec.
LED70 Min. ON
S. reel >f sec.
LED 60 Min. ON
S. reel > e sec.
LED 50 Min. ON
S. reel >d sec.
LED 40 Min. ON
S. reel > c sec.
LED30 Min. OM
S. reel > b sec.
LED 20 Min. ON
S. reel> a sec.
LED10 Min ON
YES
NO


Tape indicator LED (Front pannel)
IC 2
Tape indicator
CPU
E0
E1
E2
E3
G0
TP0
TP1
TP2
TP3
TP4
X 2
PLAY
SEARCH
FF or REW
Cassette SW
Take-up reel pulse 48 pulses/Rotation
Supply reel pulse 48 pulses/Rotation

100 Min	90 Min	80 Min	70 Min	60 Min	50 Min	40 Min	30 Min	20 Min	10 Min	TP4	TP3	TP2	TP1	TP0
ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	H	L	H	L	H
OFF	ON	ON	ON	ON	ON	ON	ON	ON	ON	H	L	H	H	L
OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON	H	L	H	H	H
OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	H	H	L	L	L
OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	H	H	L	L	H
OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	H	H	L	H	L
OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	H	H	L	H	H
OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	H	H	H	L	L
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	H	H	H	L	H
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	H	H	H	H	L
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	H	H	H	H	H
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON/OFF	L	H	H	L	H

Fig. 3-20 Tape remanining LED Function

3.1.5 Video circuit description

The video circuit system is contained on the JUNCTION, Y/C and PRE/REC boards.

1. **Junction board**
   At the junction board, an off-the-air video signal from the IF (intermediate frequency) board is applied to terminal 71, a video camera output signal to terminal 51, and a video line input to terminal 101. These signals are selected by IC2 electronic switch for AUX (auxiliary), camera or TV mode according to the E-E (electric to electric) power source. The selected signal goes from terminal 32 to terminal 24 of the Y/C board.

2. **Luminance signal**
   The input video signal goes through amplifier X7 to the AGC circuit of IC1 pin 12. This is a keyed AGC circuit which features improved response and fidelity compared with the peak AGC design. With the sync component maintained at a fixed level, the video signal is obtained from IC1 pin 11.

   IC1 (HA11701) contains AGC, pre-emphasis, white clip, dark clip and frequency modulator (FM) circuits. The video signal goes through a nonlinear emphasis circuit, then from IC2 pin 4 to emitter-follower X5. LC1 is a trap circuit for the high frequency components (particularly the color component) enhanced by the nonlinear emphasis circuit. X3 and D2 clamp the vertical sync component of the video signal and supply the result to IC1 pin 16.

   In the first clamp circuit, the video signal at IC1 pin 13 is DC clamped by the horizontal sync signal clamp drive pulse. Fig. 3-   shows the synchronization of the clamp drive pulse. From this point, the video signal goes to the pre-emphasis and AGC circuits.

   The sync level of the video signal from the first clamp is detected in the AGC detector circuit to produce the control voltage for the AGC amplifier. X2, R25, R26 and C21 form a rectifier circuit. X2 is normally off, but when noise is picked up, it switches on to stop AGC operation.

   Since AGC operation can become unstable during the absence of a signal in the period when the TV channel is being changed, on/off operation of the sync separator circuit produces a low pulse at X13 collector. This low pulse switches D8 on, discharging the AGC detector voltage of C21. When a TV

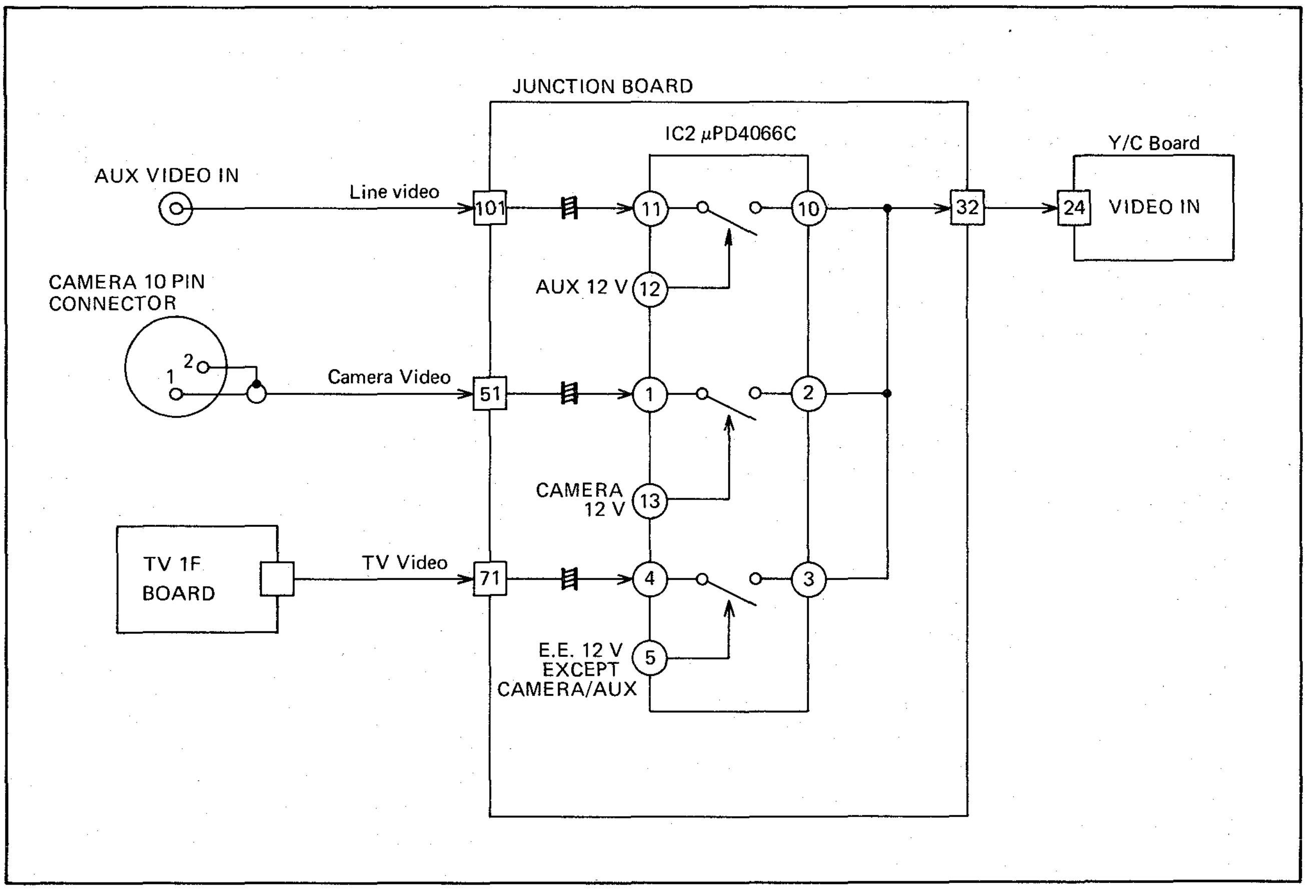

JUNCTION BOARD
IC2 μPD4066C
AUX VIDEO IN
Line video
101
11
10
32
Y/C Board
24
VIDEO IN
CAMERA 10 PIN CONNECTOR
AUX 12 V
12
2
1
Camera Video
51
1
2
CAMERA 12 V
13
TV 1F BOARD
TV Video
71
4
3
E.E. 12 V EXCEPT CAMERA/AUX
5

Fig. 3-21 Input video signal select

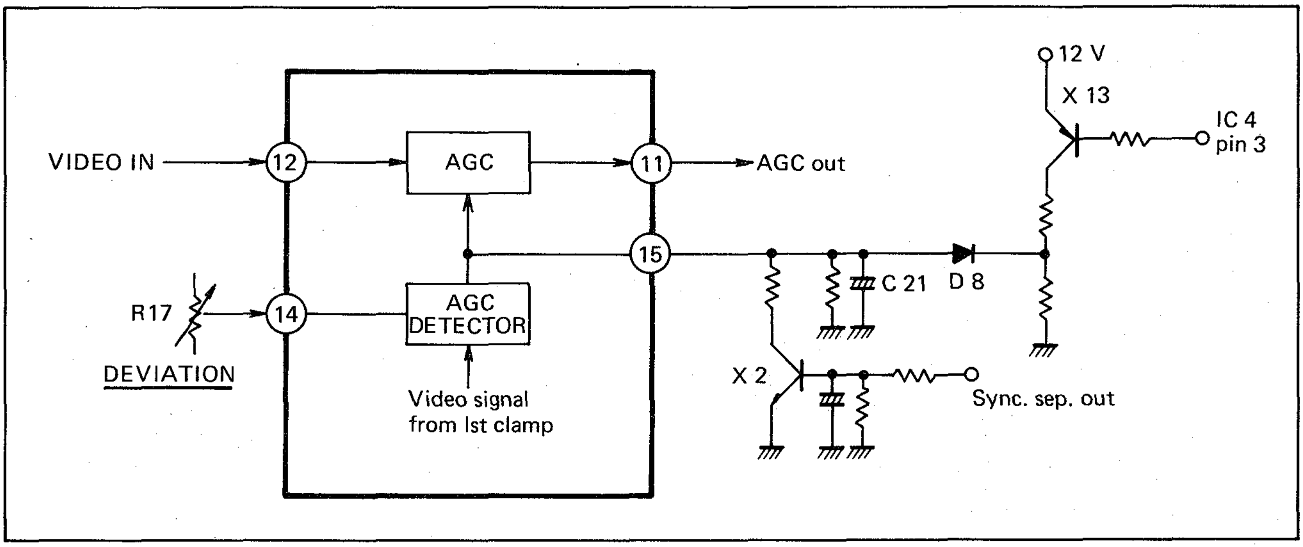

12 V
X 13
IC 4 pin 3
VIDEO IN
12
AGC
11
AGC out
15
C 21
D 8
R17
14
AGC DETECTOR
DEVIATION
Video signal from Ist clamp
X 2
Sync. sep. out

Fig. 3-22 AGC detector

signal is received, D8 cuts off. The AGC output rapidly charges C21 to stabilize AGC operation.

Following pre-emphasis of the high frequency component, the video signal goes from pin 1 to the second clamp circuit of pin 3. In this circuit, the clmap drive pulse at pin 13 is applied for precise DC clamping of the pre-emphasized video signal at the sync tip.

The video signal with fixed DC level then enters the white and dark clip circuits. White component overshoot in the pre-emphasized video signal is adjusted by R19 (WHITE CLIP), while R18 (DARK CLIP) adjusts sync overshoot to prevent over modulation at the FM oscillator.

After frequency modulation, the signal goes through a limiter circuit, then from pin 9 to high-pass filter HPF-1. This filter passes the lower side-band component of the FM signal above approx. 1.4 MHz and cuts the frequencies below this value. During recording, the color signal is converted to lowband (627 kHz ±500 kHz), mixed with the FM signal and recorded on the tape. HPF-1 thus functions to prevent interference between the color signal and the FM lower sideband. Fig. 3- indicates the response curve of HPF-1.

The FM signal goes through X1 emitter-follower and from terminal 31 to terminal 23 of the PRE/REC board. There it is mixed with the color signal and supplied to the recording amplifier (X8 to X12) for recording.

3. **Color signal**

Bandpass filter BPF-1 separates the 4.43 MHz ±500 kHz color signal and supplies it to IC201 pin 3. A switching circuit detects playback or recording mode, and from IC201 pin 3 or pin 4, the color signal goes to the ACC (automatic color correction) circuit. This circuit regulates the color level, after which the signal is sent via pins 5 and 6 to the main converter.

At the main converter, a 5.06 MHz signal from BPF302 is applied to pin 8 during recording. Sum and difference outputs are then obtained from pin 9 of the main converter. Lowpass filter LPF201 separates the difference component of 627 kHz ±500 kHz, which becomes the lowband converted color signal. Fig. 3-28 shows the block of IC201.

The converted color signal enters IC201 pin 12 and goes through switching and REC killer circuits, then to output pin 11. From this point, the color signal is applied to the pre-REC amplifier, where it is mixed with the FM luminance signal for recording.

4. **Nonlinear emphasis**

The nonlinear circuit is intended to prevent reversal phenomena during recording and playback, and improve S/N. Although the double limiter circuit improves S/N, due to the increased amount of pre-emphasis, spike signals can be produced at the rising components from black to white in the video signal. Under certain conditions, these spikes can cause black-white reversal effects.

For this reason, a nonlinear emphasis circuit is added to the double limiter for varying the pre-emphasis amount according to the input signal level. This serves to both improve playback S/N and avoid reversal effects. The pre-emphasis variation with respect to the input video signal level and frequency is depicted in Fig. 3- . With this circuit a playback S/N improvement of from 3 to 4 dB is attainable in comparison to previous designs.

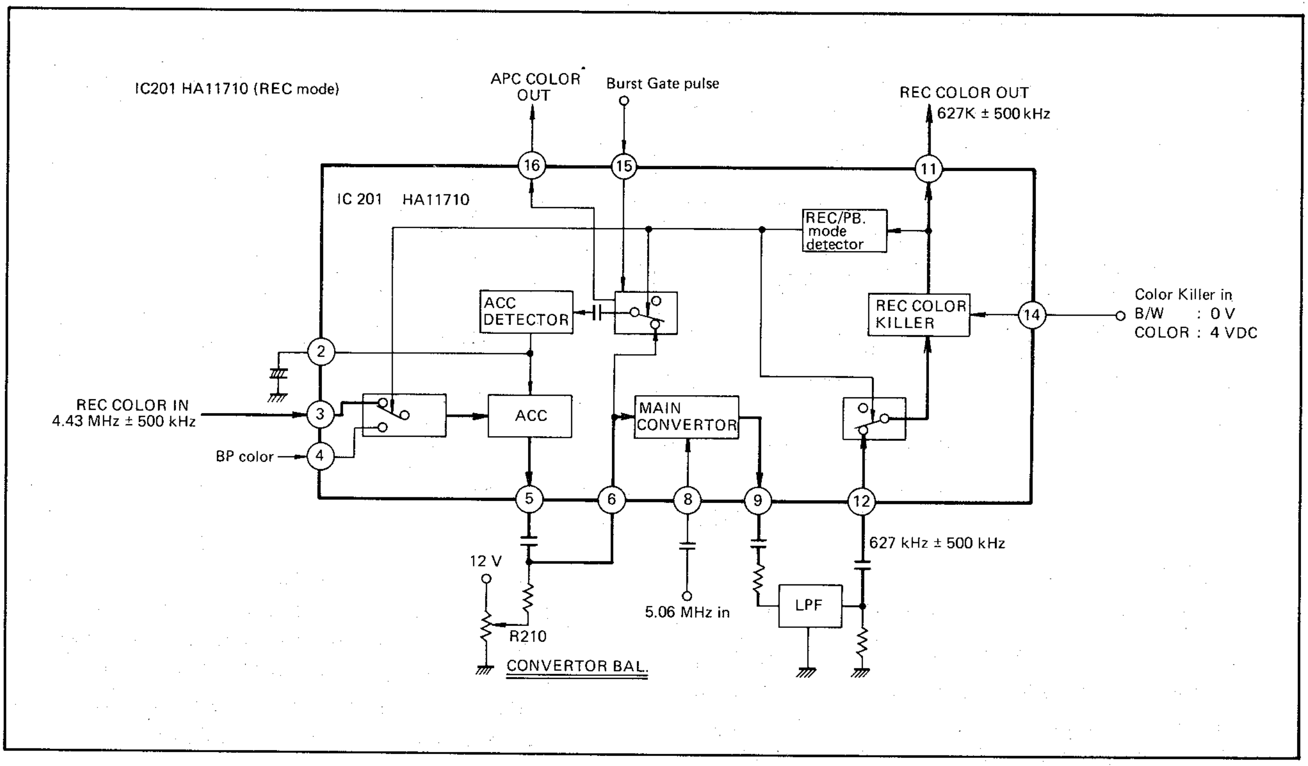

IC201 HA11710 (REC mode)
APC COLOR OUT
Burst Gate pulse
REC COLOR OUT
627K ± 500kHz
16
15
11
IC 201 HA11710
REC/PB. mode detector
ACC DETECTOR
REC COLOR KILLER
14
Color Killer in
B/W : 0 V
COLOR : 4 VDC
2
REC COLOR IN
4.43 MHz ± 500 kHz
3
BP color
4
ACC
MAIN CONVERTOR
5
6
8
9
12
627 kHz ± 500 kHz
12 V
R210
CONVERTOR BAL.
5.06 MHz in
LPF

Fig. 3-23 Color recording signal path (HA11710)

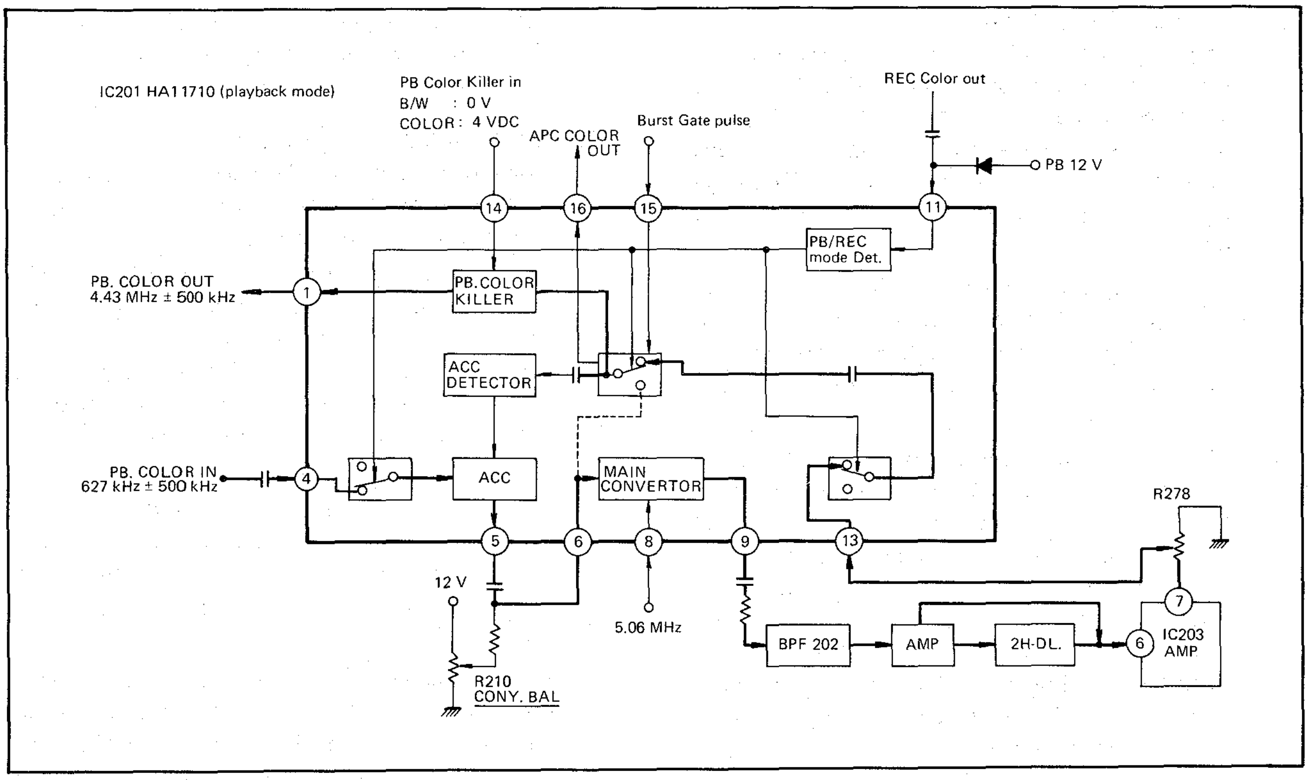

IC201 HA11710 (playback mode)
PB Color Killer in
B/W : 0 V
COLOR: 4 VDC
APC COLOR OUT
Burst Gate pulse
REC Color out
PB 12 V
14
16
15
11
PB/REC mode Det.
PB. COLOR OUT 4.43 MHz ± 500 kHz
1
PB.COLOR KILLER
ACC DETECTOR
PB. COLOR IN 627 kHz ± 500 kHz
4
ACC
MAIN CONVERTOR
R278
5
6
8
9
13
12 V
5.06 MHz
R210 CONV. BAL
BPF 202
AMP
2H-DL.
6
7
IC203 AMP

Fig. 3-24 Color playback signal path (HA11710)

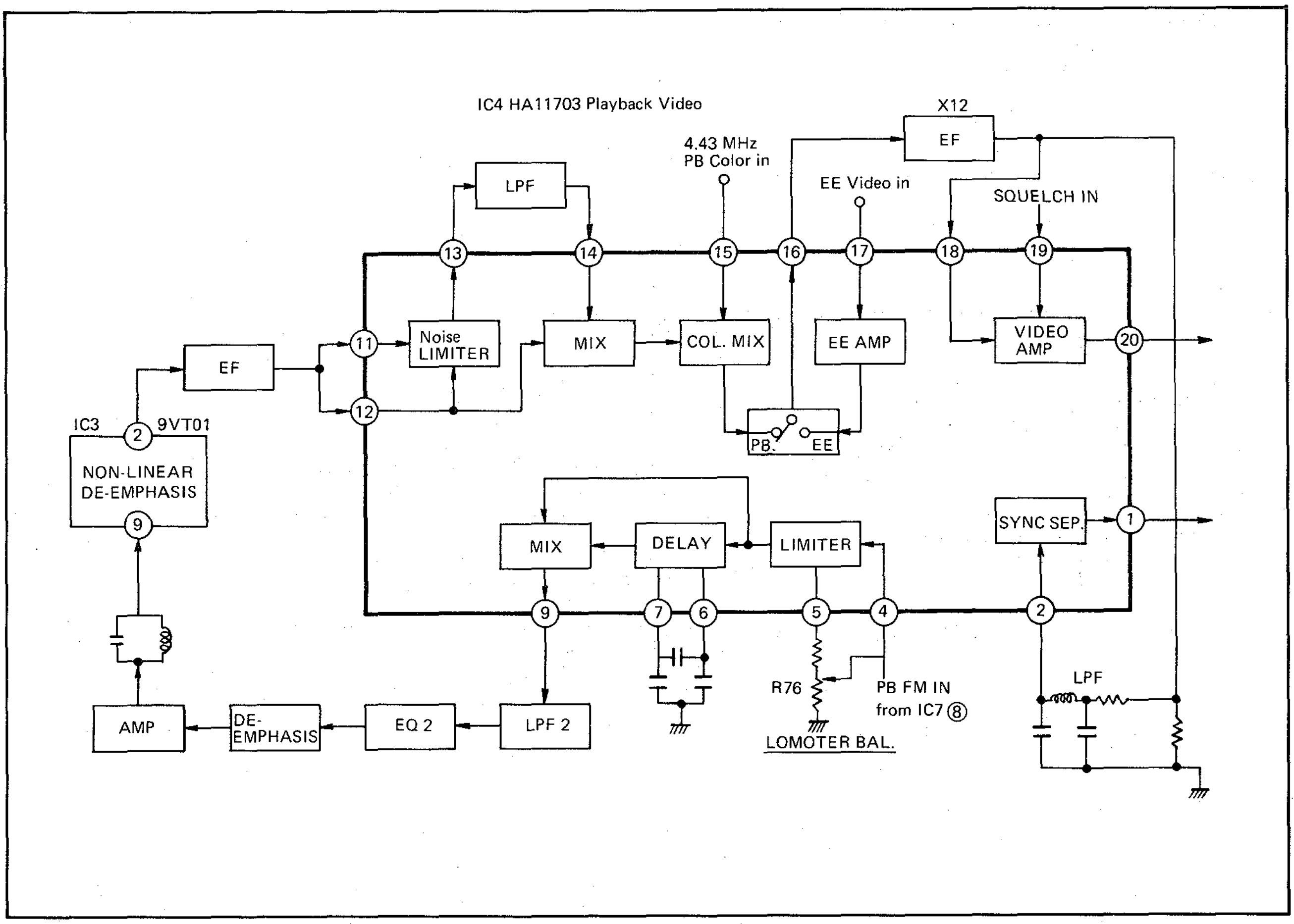

IC4 HA11703 Playback Video
X12
EF
4.43 MHz PB Color in
EE Video in
SQUELCH IN
LPF
13
14
15
16
17
18
19
Noise LIMITER
MIX
COL. MIX
EE AMP
VIDEO AMP
20
EF
11
12
IC3
2
9VT01
NON-LINEAR DE-EMPHASIS
9
PB.
EE
MIX
DELAY
LIMITER
SYNC SEP.
1
9
7
6
5
4
2
R76
PB FM IN from IC7 ⑧
LOMOTER BAL.
LPF
AMP
DE-EMPHASIS
EQ 2
LPF 2

Fig. 3-25 Playback video signal path (HA11703)

5. **Preamp IC3 (HA11718)**

The functions of this IC include FM switcher, FM AGC and dropout compensation (DOC). The preamplified outputs of CH-1 and CH-2 and applied to IC3 pins 7 and 3, which the drum flipflop signal goes to pin 1. This pulse is used by the FM switcher to produce a continuous FM output signal at pin 15.

A highpass filter composed of R18, R19, C27 and L3 yields the luminance component of the FM output signal. At the same time, LPF-1 extracts the lowband color signal and sends it to the color circuit.

The FM luminance signal goes via pin 14 to the AGC circuit, in which the AGC detector functions to maintain a fixed FM level. This output is applied to the plus (+) side of the DOC opamp (operational amplifier). The time constant of the opamp pins 9 and 10 determines the DOC detector level. Since the FM signal from the AGC circuit is at a fixed level, highly stable DOC operation becomes possible. This also eliminates the need for a DOC level adjustment control.

From the opamp, the 1H delayed FM signal goes through the DOC switching circuit to the mixer. In event of a tape dropout (loss of signal due to a defect in the tape), the FM signal is mixed with the 1H delayed dropout FM signal and the output is obtained from terminal 12.

6. **HA11706 (IC203 and IC206)**

This IC is employed for color APC (automatic phase control), ID (identification pulse) detector and color killer detector circuits.

The playback color signal (4.43 MHz ±500 kHz) is applied via pin 8 to phase detector-1 (APC detector) and to phase detector-2 (killer detector) as the comparison signal. Via pin 13, the burst gate pulse goes to the phase detector for comparison with the burst component of the playback color signal.

A 4.43 MHz crystal oscillator provides the reference signal for phase detectors 1 and 2 via pin 12. This is switched and appears at pin 11. A capacitor-resistor (CR) circuit shifts the phase of the reference signal by 90° and supplies it via pin 9 to the amplifier.

When the playback burst signal is 90° out of phase with the crystal reference, phase detector-1 output becomes zero. In the ±90° range (0° to 180°), the phase detector output varies linearly and regulates the VCO (voltage controlled oscillator) frequency.

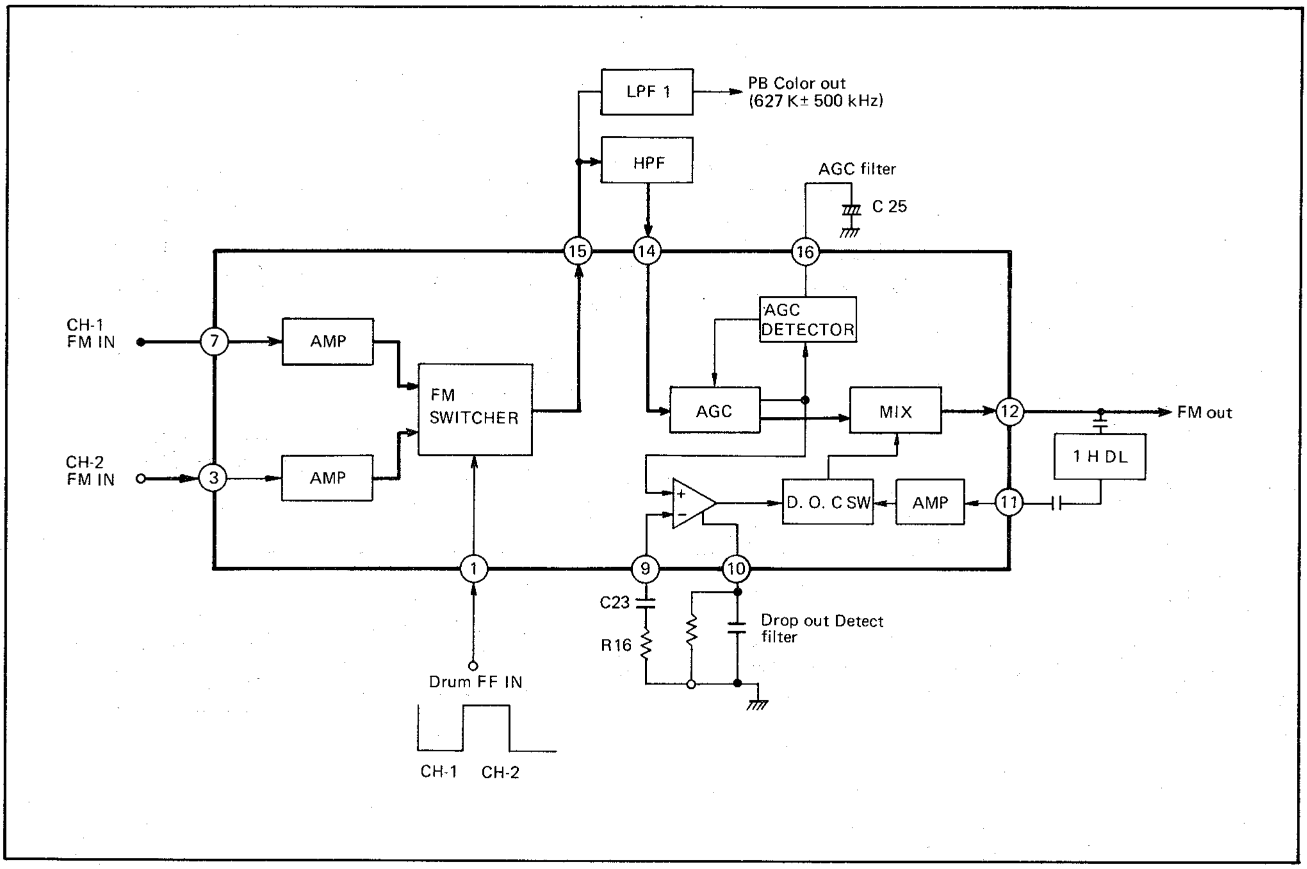


Fig. 3-26 Preamp (HA11718)

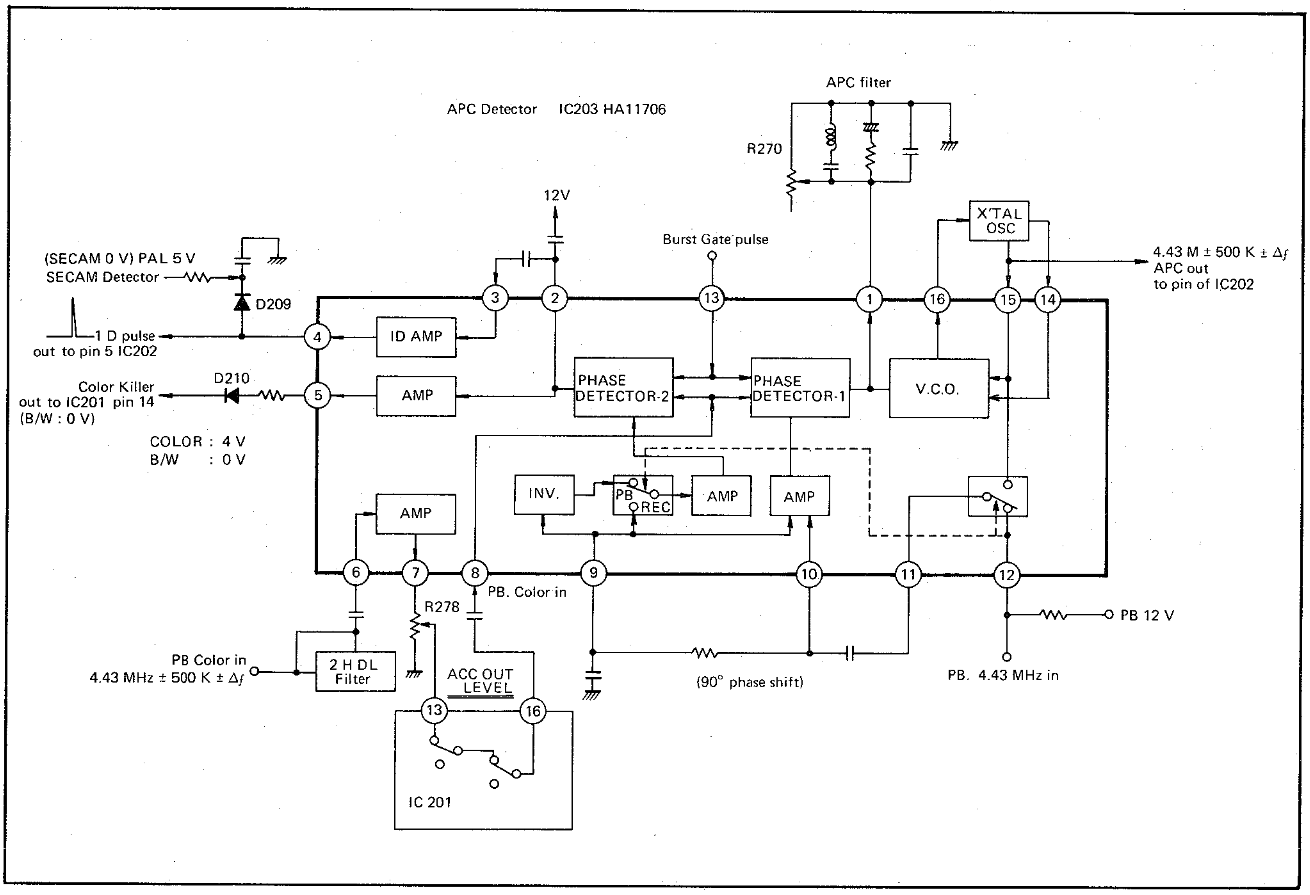

APC filter
APC Detector IC203 HA11706
R270
12V
Burst Gate pulse
X'TAL OSC
4.43 M ± 500 K ± Δf APC out to pin of IC202
(SECAM 0 V) PAL 5 V
SECAM Detector
D209
1 D pulse out to pin 5 IC202
ID AMP
Color Killer out to IC201 pin 14 (B/W : 0 V)
D210
AMP
COLOR : 4 V
B/W : 0 V
PHASE DETECTOR-2
PHASE DETECTOR-1
V.C.O.
INV.
PB
REC
AMP
AMP
AMP
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
PB. Color in
R278
PB 12 V
PB Color in 4.43 MHz ± 500 K ± Δf
2 H DL Filter
ACC OUT LEVEL
(90° phase shift)
PB. 4.43 MHz in
13
16
IC 201

Fig. 3-27 APC detector (HA117106)

At phase detector-2, the reference signal input is advanced by 90° and inverted. Since the playback burst signal is stabilized at 90°, the output is positive in the range of ±90° centered on the +90° playback burst phase.

In other words, when the playback color phase is within ±90°, the output is high and the color killer does not operate. However, if there is a large deviation in phase, the output goes low and the color killer operates.

When phase detector-2 detects phase outside the range of 90° ±90°, a positive ID pulse is obtained from pin 4.

7. HA11717 (IC202) AFC

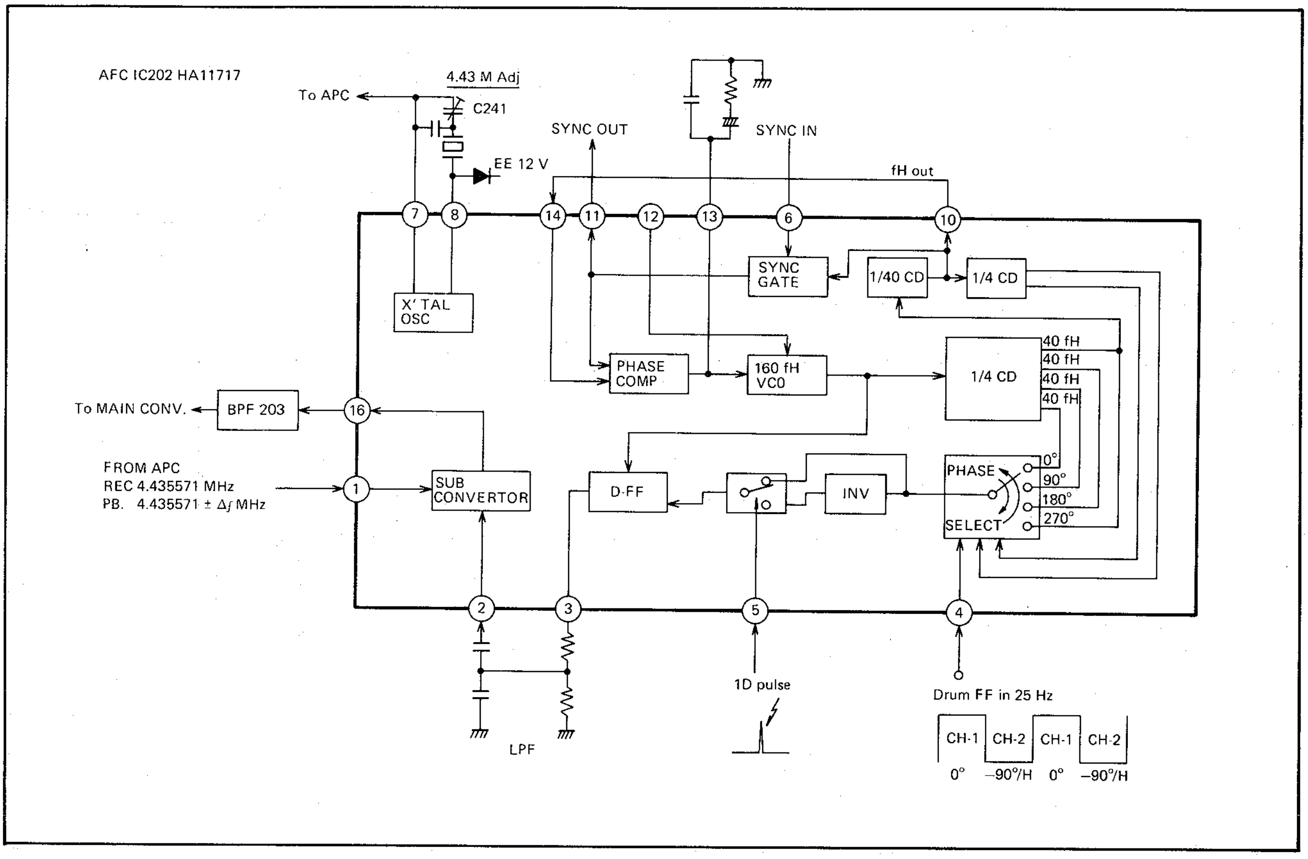

AFC IC202 HA11717
To APC
4.43 M Adj
C241
SYNC OUT
SYNC IN
EE 12 V
fH out
7
8
14
11
12
13
6
10
X' TAL OSC
SYNC GATE
1/40 CD
1/4 CD
PHASE COMP
160 fH VCO
1/4 CD
40 fH
40 fH
40 fH
40 fH
To MAIN CONV.
BPF 203
16
FROM APC
REC 4.435571 MHz
PB. 4.435571 ± Δf MHz
1
SUB CONVERTOR
D-FF
INV
PHASE SELECT
0°
90°
180°
270°
2
3
5
4
LPF
1D pulse
Drum FF in 25 Hz
CH-1
CH-2
CH-1
CH-2
0°
-90°/H
0°
-90°/H

Fig. 3-28 AFC (HA11717)

3.1.6 Edit start control

When the REC PAUSE key is pressed, 20 frames of tape is rewound, then the Pause mode entered. At this time, pressing the PLAY key provides 12 frames of playback, then the recording mode is entered with 8 frames of overlap.

However, since this amounts to about 0.3 sec. of the playback picture, the picture disturbance is negligible in ordinary applications.

The edit function is explained additionally in the mechanism control circuit description.

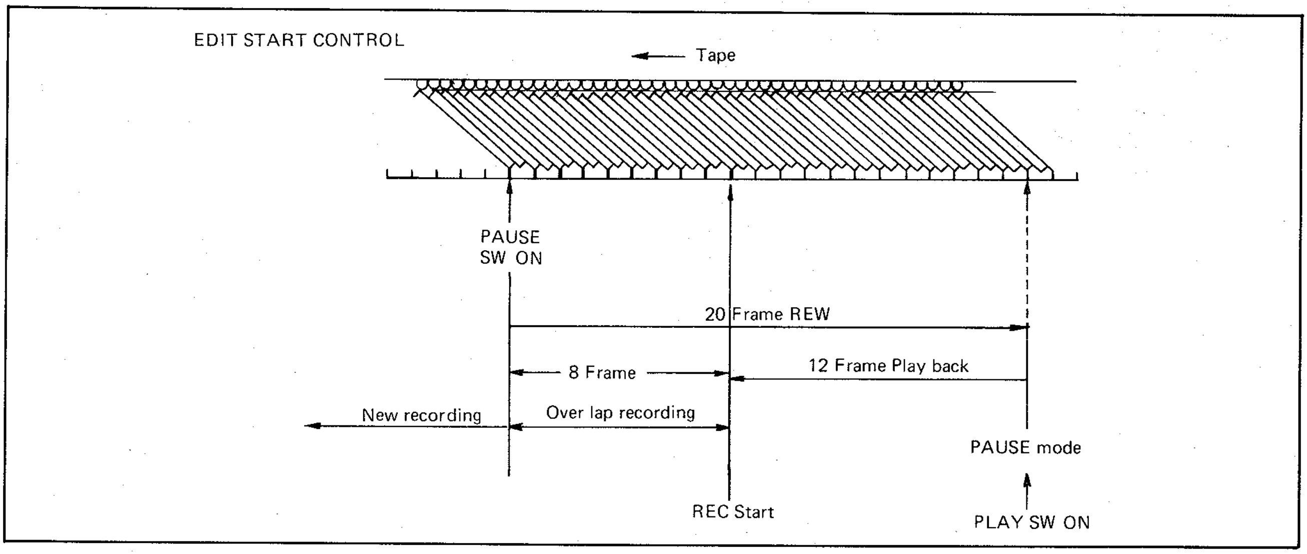

EDIT START CONTROL
Tape
PAUSE SW ON
20 Frame REW
8 Frame
12 Frame Play back
New recording
Over lap recording
PAUSE mode
REC Start
PLAY SW ON

Fig. 3-29 Edit start control

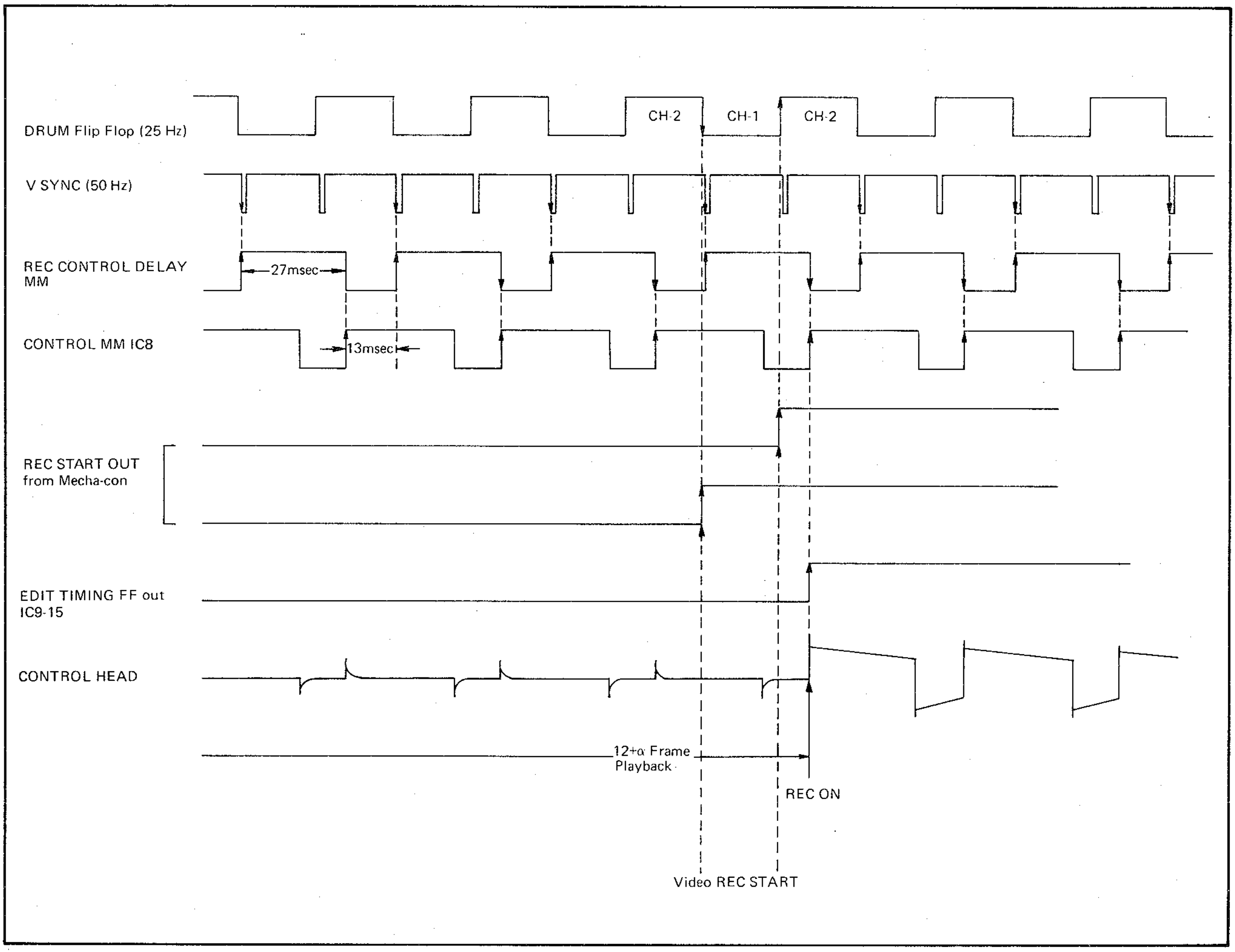


Fig. 3-30 Edit start timing chart

3.1.7 Servo circuit block diagram description

Three servo circuits are included: drum, capstan and reel.

1. **Drum servo**

   The drum servo circuit is contained on the SERVO-2 board. A direct drive DC motor drives the video head drum. Sixty rotating magnets and fixed detector coils (FG board) produce a 1.5 kHz FG pulse, which is used for speed servo control.

   During recording, a 25 Hz flipflop signal from the rotating head drum is compared in phase with the vertical sync component of the input video signal to perform phase control. This system functions to maintain fixed speed rotation of the video heads. At this time, the control signal is supplied to the control head and recorded on the tape to serve as reference during playback.

   During playback, a crystal oscillator signal is divided to 25 Hz to form the control reference for video head rotation.

2. **Capstan servo**

   This circuit is also contained on the SERVO-2 board and functions to maintain fixed tape speed. A DC motor drives the capstan via a belt. The DC motor flywheel contains 121 magnets which are detected by coils of the FG board to produce a 225 Hz pulse for speed servo control. At the same time, the FG pulse is divided to 25 Hz, which is compared with the sync component of the input video signal to perform phase servo control.

   During playback, servo control is performed by comparing the phase of the playback control pulse with that obtained from a crystal oscillator. At the time of variable speed playback (slow and frame advance), pulse drive is obtained from BA841 of the SERVO-1 board.

3. **Reel servo**

   The reel servo circuit is included with the mecha-con circuit. During shuttle search, the control signal of the tape is detected and speed is controlled by varying the reel motor rotation. In other modes, regulated voltage is supplied to control reel rotation according to mode.

3.2 MECHANISM CONTROL CIRCUIT

3.2.1 Operation and functions

This model features a microcomputer based mechanism control (mechacon) circuit. The main objective of this circuit is to coordinate the electrical and mechanical functions of the machine to properly implement the various operating modes.
With reference to inputs from the front panel mode switches, infrared remote controller, machine sensors and microswitches, electrical parts such as motors and solenoids are controlled so that mechanical components assume the required states.

Since the internal sensors, continuously detect mechanical and tape running modes in event of incorrect operating procedure by the user, control is performed in order to prevent possible damage to the machine or tape.

The main functions of the mechacon circuit can be listed as follows.

1. According to signals from the function switches, operate the required mechanisms to set up the selected mode (parallel to serial and serial to parallel decoders are employed).
2. Monitor states of sensors and microswitches in order to prevent damage to the machine or tape. (Data Selecter)
3. Detect reel disk rotation and send tape remaining data to the display. (⑧ Tape remaining indicator)
4. Detect signal from remote controller.
5. According to the setting of the front panel TAPE MEMORY switches, perform control for such modes as Search, Repeat and Counter Repeat.
6. Tape remaining and tape counter signals are sent to the tuner/timer circuit and counter control is performed.
7. Tape counter operates from supply reel pulse.

3.2.2 Operation characteristics

Power ON-OFF Parameters

1. Power ON state
   The front panel ON indicator lights and all operations are enabled, including cassette insertion and removal.

2. Power ON conditions
   The rear panel POWER switch must be ON.
   1) If the ON switch is already depressed when the rear panel AC switch is set to ON, the POWER indicator does not light (power ON mode not obtained). In this case, press either the OFF or TIMER button, then again press the ON button.
   2) The front panel ON switch must be pressed to enable power ON/OFF operation from the remote control unit.
   3) When the front panel TIMER button is depressed, the power ON state becomes obtained at the time set with the program timer.

3. Initial operation after power ON
   In absence of a cassette, the cassette housing motor rotates for 1 second in the Eject direction, then stops. All mode indicators are extinguished.
   When a cassette is present, but the tape is not loaded, the cassette housing motor rotates for approx. one second in the intake direction, then the Stop mode is obtained. If the tape is loaded (wrapped about the head drum), the unloading mode is entered.

4. Power OFF state
   The front panel ON indicator is extinguished. All operations are disabled, including cassette insertion and removal. Operations in progress prior to the power OFF state stop due to power cut off.

5. Power OFF conditions
   1) Rear panel POWER switch OFF, power cord disconnected from AC outlet, or other interruption of commercial AC power. At the return of AC power, the power ON state is not obtained. In the case of timer operation, if the duration of the power absence exceeds the capability of the back-up feature, the power ON state becomes inhibited.
   2) Front panel OFF button depressed.
   3) Front panel TIMER button depressed, but "real time" is not within the period set by the program timer.
   4) Operating the OFF button of the remote control unit.

	STOP	PLAY	STELL/ PAUSE	SLOW	X 2	FRAME ADV.	S.F.F.	S. REW.	F.F.	REW.	REC & PLAY	REC & PAUSE	A. DUB & PLAY	A. DUB & PAUSE	EJECT
STOP		○	×	×	×	×	×	×	○	○	○	○	○	○	○
PLAY	○		○	○	○	×	○	○	○	○	○	○	○	○	○
STILL	○	○		○	○	○	○	○	○	○	○	○	○	○	○
SLOW	○	○	○		○	×	○	○	○	○	○	○	○	○	○
X 2	○	○	○	○		×	○	○	○	○	○	○	○	○	○
S.F.F.	× (PLAY)	○	× (PLAY)	× (PLAY)	× (PLAY)	× (PLAY)	○	× (PLAY)	× (PLAY)	× (PLAY)	× (PLAY)	× (PLAY)	× (PLAY)	× (PLAY)	× (PLAY)
S. REW.	× (PLAY)	○	× (PLAY)	× (PLAY)	× (PLAY)	× (PLAY)	× (PLAY)	○	× (PLAY)	× (PLAY)	× (PLAY)	× (PLAY)	× (PLAY)	× (PLAY)	× (PLAY)
F.F.	○	○	×	×	×	×	×	×		○	○	○	○	○	○
REW.	○	○	×	×	×	×	×	×	○		○	○	○	○	○
REC. PLAY	○		○ REC. PAUSE	×	×	×	×	×	×	×		○	×	×	×
REC. PAUSE	○	○ REC. PLAY		×	×	×	×	×	×	×	○		×	×	×
A. DUB PLAY	○		○ A. DUB. PAUSE	×	×	×	×	×	×	×	○	○		○	×
A. DUB. PAUSE	○	○ A.DUB. PAUSE		×	×	×	×	×	×	×	○	○	○		×
EJECT Un loading	○	○	×	×	×	×	×	×	○	○	○	○	○	○	
EJECT Un loading	×	×	×	×	×	×	×	×	×	×	×	×	×	×	

Table 3-2 Mode selection table

General Operations

1. Selection between modes is indicated in the mode selection table.
2. The operating buttons of the main unit possess priority over those of the remote control unit. This includes power ON-OFF operations.
3. With the exceptions mentioned below, simultaneously pressing two or more operating buttons produces a "no operation", i.e., the effect is the same as not pressing any button.
4. Simultaneous pressing is allowed for the REC and AUDIO DUB buttons with respect to the PLAY and PAUSE/STILL buttons.
5. The REC and AUDIO DUB buttons are ineffective when pressed simultaneously with buttons other then PLAY and PAUSE/STILL. For example, simultaneously pressing the REC and FF buttons yields only the fast forward mode.

Automatic Operations

1. Auto Stop enable
   1) At beginning of tape in the Rewind mode.
   2) When the tape counter reaches 0000 during FF or REW in the counter-search mode.
   3) Cue signal detected during FF or REW in the cue-search mode.
   4) If the supply reel does not rotate within 3 seconds after the FF mode has been selected.
   5) If the take-up reel does not rotate within 3 seconds after the REW mode has been selected.
   6) When Pause/Still or Slow mode has continued for 5 to 7 minutes.
   7) With the exception of Pause/Still, Slow and search, if the take-up reel does not rotate within 3 seconds after the Play mode has been selected.
   8) If the drum does not rotate within 3 seconds after unloading switch (UL) OFF has been detected. In this case, all operations are inhibited and all indicators extinguished until the drum starts rotating or the power is interrupted, then resupplied.

9) When the loading process is not completed within approx. 6 seconds after selection of the Play (REC) mode.

2. Auto Eject enable
   1) End of tape in the timer recording mode.
   2) Cassette detector lamp failure.
   3) Cassette switch does not close within approx. 6 seconds after a cassette is inserted.
   4) Simultaneous detection of tape start and tape end (i.e., tape breakage or similar event).
   5) Cassette switch change from ON to OFF state.

3. Auto Rewind enable
   1) End of tape in modes other than timer, Search and Still.
   2) When the tape counter reaches 0000 during Play in the counter-repeat or cue-repeat mode.

4. Auto Play enable
   1) At beginning of tape during Rewind in the Repeat mode.
   2) Cue signal detected during Rewind in the Cue-repeat mode.
   3) When the program set time is reached in the Timer mode. Ten seconds prior to the set time, the Pause/Still mode is entered. If recording and the cassette REC safety tab is present, the Recording mode is entered. In absence of the REC safety tab, the Play mode becomes produced.

5. Auto Pause/Still enable
   1) End of tape in the search-FF mode.
   2) Beginning of tape in the search-REW mode.
   3) Ten seconds prior to set of recording (playback) time in the timer mode.

6. Warning mode
   1) If the unloading process is not completed within approx. 6 seconds, all drive mechnisms stop, with the exceptions of the drum and capstan motors. Indicators for the previously selected mode flash and other operations are inhibited.
   2) If the eject process is not completed within about 6 seconds, all drive mechanisms stop and the EJECT indicator flashes. All modes are inhibited.

Timer Mode

1. Timer mode parameters
   1) During the timer mode (Timer recording), all other operations are inhibited.
   2) In principle, the timer mode yields the Recording mode. However, if the cassette REC safety tab is missing, the Play mode becomes produced.
   3) In the timer mode, the power ON state is attained when the program set time is reached. During the timer set time period, manually pressing the OFF button, then the ON button produces the Play (REC) mode. Similarly, if a cassette is absent at this time, inserting a cassette yields the Play (REC) mode.

2. Initial operations after power ON
   1) If a cassette is absent, the cassette housing motor rotates in the Eject direction for 1 second, then stops. All indicators extinguish. Inserting a cassette at this time produces the Play (REC) mode.
   2) When a cassette is present, but the cassette switch is not pressed, the Eject mode becomes entered.
   3) With a cassette present and the cassette switch closed, if the tape is not loaded, the cassette housing motor turns in the loading direction for approx. 1 second, after which the Play (REC) mode is obtained.
   4) If the tape is loaded, the REC-Pause (Play) mode is entered.
   5) At end of tape in the above (3 and 4) conditions, the Eject mode is entered.

Camera Pause and Wired Pause (Rear panel)

1. Camera Pause is enabled only in the REC mode with the input selector switch set to CAMERA.

2. In the REC mode, with the input selector switch set to CAMERA, but without a signal connected to the CAMERA connector, the REC-Pause mode is produced. With a camera connected and camera is set to CAMERA Pause mode, this mode is also obtained when selected from the camera. In either case, operating the mainframe selectors will not provide the REC-Play mode.

3. Wired Pause (rear panel jack) is enabled only during the REC mode.

4. When REC-Pause is selected using wired Pause, operating the mainframe selectors will not produce the REC-Play mode.

5. If REC-Pause has been set by the mainframe selectors, it can be released by the Camera Pause or Wired Pause facility. In this case, briefly set the Camera (Wired) Pause control to Pause, then to Play.

6. When the camera or Wired Pause switch is set to Play, the mainframe controls are not inhibited.

7. When both Camera and Wired Pause are used, the Pause mode is entered. Until released, the REC-Play mode cannot be produced by mainframe selectors.

3.2.3 SW and Sensor function

Name of SW	Time when activated	Activated by	Detect signal
COUNTER SW	Front panel TAPE MEMORY SW to COUNTER position.	MANUAL	L
REPEAT SW	TAPE MEMORY SW to REPEAT position	"	L
SEARCH SW	TAPE MEMORY SW to SEARCH position	"	L
CUE SW	TAPE MEMORY SW to CUE position	"	L
CASSETTE SW	Cassette is loaded.	CASSETTE	L
UL SW	At loading arm stow	LOADING RING	L
AL SW	Loading end	"	L
CASSETTE LAMP	Power ON	–	–
SUPPLY REEL DET.	All functions except STOP	Photo Sensor	Reel pulse
TAKE-UP REEL DET.	"	"	Reel pulse
START SENSOR	REW, Search-REW	Cassette Lamp	L
END SENSOR	Play (All Play), REC, FF, S-FF	"	L
CASSETTE DET.	Beginning of Cassette Load end of Eject	Cassette Det. Lever	L
REC SAFETY	REC	REC SAFETY Lever	L
CUE HEAD	REW/FF	Cassette Tape	30 Hz Cue Signal

Table 3-3 SW and sensor

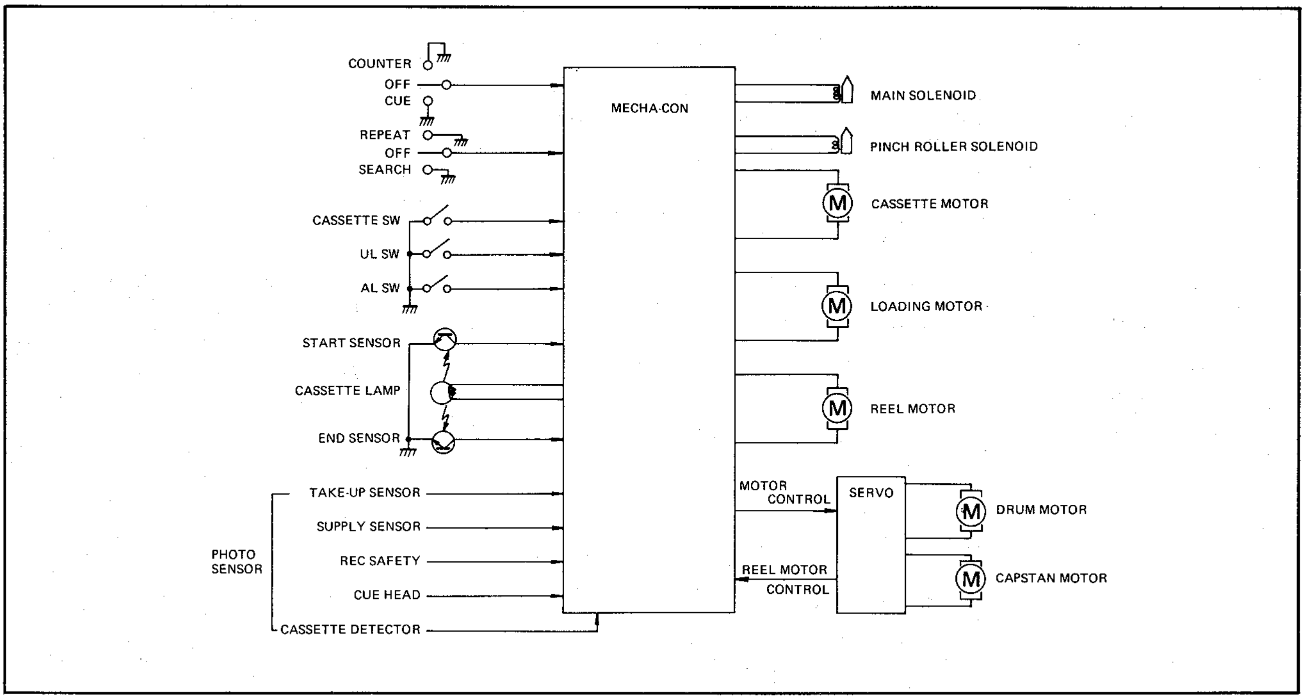

COUNTER
OFF
CUE
REPEAT
OFF
SEARCH
CASSETTE SW
UL SW
AL SW
START SENSOR
CASSETTE LAMP
END SENSOR
TAKE-UP SENSOR
SUPPLY SENSOR
PHOTO SENSOR
REC SAFETY
CUE HEAD
CASSETTE DETECTOR
MECHA-CON
MAIN SOLENOID
PINCH ROLLER SOLENOID
M
CASSETTE MOTOR
M
LOADING MOTOR
M
REEL MOTOR
MOTOR CONTROL
SERVO
REEL MOTOR CONTROL
M
DRUM MOTOR
M
CAPSTAN MOTOR

Fig. 3-31 Input and output of mechanism control circuit

3.2.4 Microcomputer principle

As the name implies, a microcomputer (or "μcom" as it is called in technical literature) is an ultra-miniaturized computer. But in spite of its tiny size, it contains all the fundamental elements common to computers of any size. These elements are indicated in Fig. 3-32.

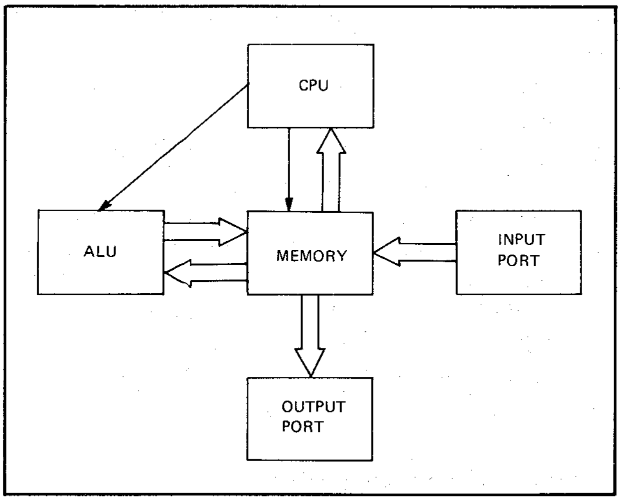

CPU
ALU
MEMORY
INPUT PORT
OUTPUT PORT

Fig. 3-32 Micro computer principle function

This model employs several one-chip μcoms. Each of these includes all of the above fundamental elements in a single LSI (large scale integration) package. However, only the tuner and timer μcoms are used as true computers, i.e., they are externally programmable, while the others, including that for the mechacon circuit, are employed as microprocessors (factory programmed and cannot be reprogrammed by the user).

The main reasons for using μcom control in this model are as follows.

1. Higher reliability than mechanical type switches.
2. Reduced cost of μcoms accompanying advances in semiconductor manufacturing technology.
3. As various programs can be compiled, they are adaptable to a wide range of functions.

Over the coming years, the increased use of μcoms in VHS and related products can be anticipated. Indeed, the one-chip μcom is rapidly becoming a VHS component in itself, along with transistors, ICs and other electronic elements. For this reason, an understanding of microcomputer principles is essential for service technicians involved in technically advanced products such as VHS.

As illustrated in Fig. 3-33, the one-chip μcom consists of CPU (central processing unit), ROM (read only memory), RAM (random access memory), I/O (input/output) ports, and a Clock Generator.
Following are brief descriptions of these sections.

1. CPU

This is the main functional section of a μcom (or any computer, regardless of size) and possesses judgement and processing capabilities. As outlined in Fig. 4, the controller/gate obtains instructions sequentially from the memory, decodes them, and supplies them to the ALU (arithmetic/logic unit). In accordance with the instructions, the ALU processes the input data. The results are temporarily stored in a register, then sent to the output interface.

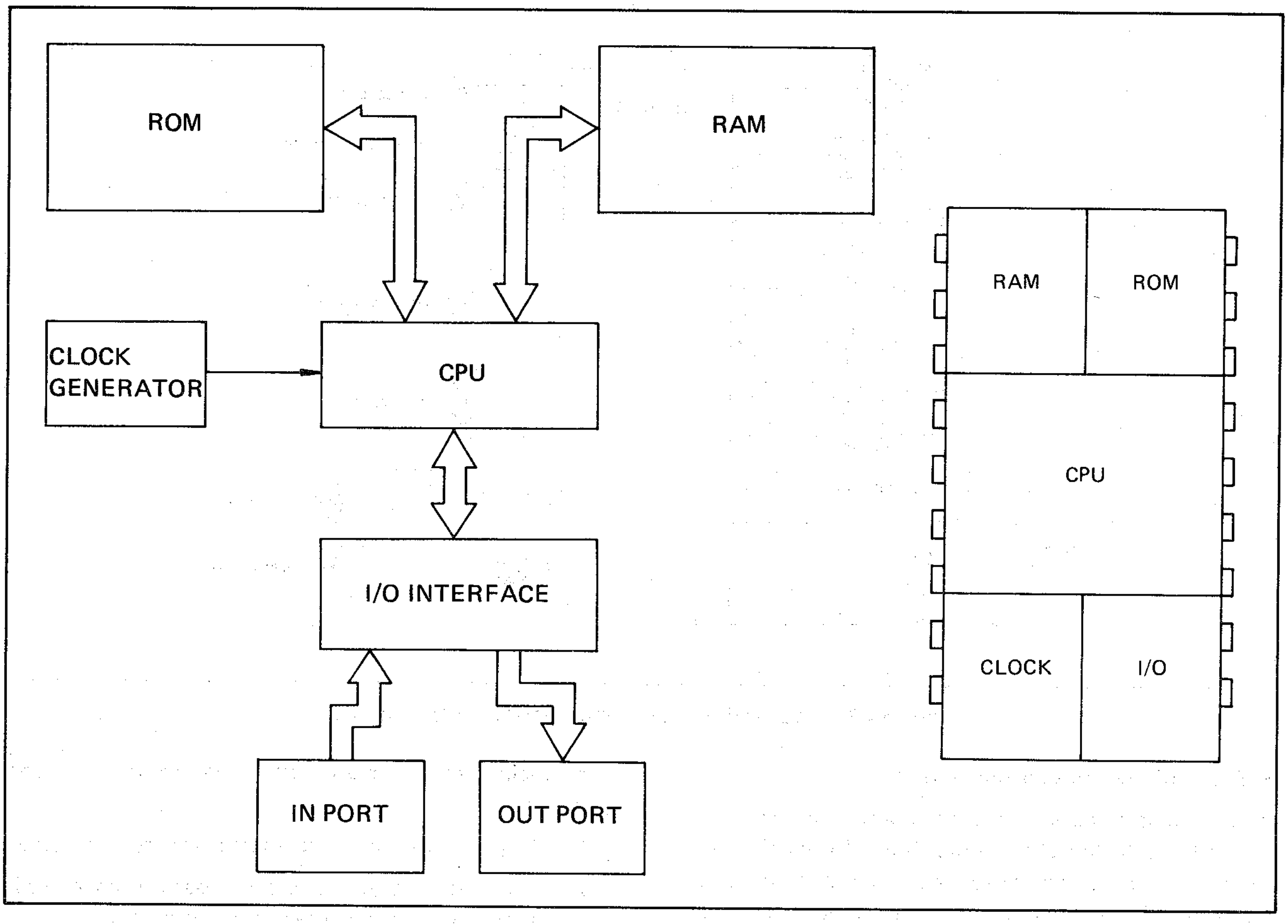


Fig. 3-33 One chip micro computer

2. Memories

The ROM stores the instruction program, while the RAM stores the externally supplied data. The μcoms in this model employ "mask ROMs", in which programs are written beforehand and cannot be altered. The mask ROM has a cost advantage when writing the same program into a large number of the same LSIs.

3. Clock generator

A μcom requires a time reference to ensure the orderly performance of the CPU functions. The various operations, including the acceptance of instructions from the ROM, decoding and executing the instructions, are synchronized to the clock pulse (400 kHz for this model) produced by the clock generator.

3.2.5 Microcomputer LSI descriptions

One-chip 4-bit microcomputers are employed in this model. Types are μPD650C-049 (T/T circuit), μPD553C-072 (mechacon), μPD554C-306 (mechacon) and μPD564C-155 (T/T). Each μcom is contained on a single semiconductor chip and includes parallel processing CPU, ROM, RAM, I/O ports, programmable timer, control circuit and clock oscillator.

The main features of these devices can be listed as follows.

1. One-chip 4-bit microcomputer for control applications
2. Instruction cycle of 10 μsec (f = 400 kHz)
3. Versatile bit operating and skip instructions
4. Wide variety of input and output instructions
5. Base 2 addition, base 10 addition and subtraction, and logic operations
6. ROM is 2000 x 8 bits (1000 x 8 bits for μPD554C-036)
7. RAM is 94 x 4 bits (32 x 4 bits for μPD554C-036)
8. Three levels of subroutines

Mecha-con circuit μcom (μPD553C)

Mecha-con circuit control is performed using a μPD553C, μPD554C microcomputer. The main functions of the control circuit are as follows.

1. Operate main solenoids according to mode.
2. Control pinch roller solenoid according to mode.
3. Control loading motor rotation.
4. Control cassette motor rotation.
5. Control reel motor rotation.
6. Control recording start.

7. Control function LED (light emitting diode) lighting.
8. Control cue signal recording.
9. Control tape counter up/down mode.
10. Control tape remaining and counter displays.
11. Control tuner.
12. Control power supply to circuits.
13. Issue tape speed instructions for servo circuit.
14. Detect take-up and supply reel disk rotation.
15. Issue search and repeat instructions according to tape memory switch position.
16. Mode control with respect to infrared remote control unit.
17. Operation control with respect to serial digital pulse signal.
18. Search and repeat function according to cue signal.
19. Edit control according to REC/Pause.
20. Control tape speed in search mode.
21. Control tape speed during FF and REW.

3.2.6 Microcomputer description

For reference purposes, a description of this microcomputer is provided in the following, based on data supplied by the manufacturer.

1. Terminal Functions

   The microcomputer is contained in a 42 pin DIP (dual inline package) and includes ALU (arithmetic logic unit), ROM (read only memory), RAM (random access memory), I/O ports (input/output ports) and control circuitry. Pin functions are as shown in the following table (also refer to pinout and block diagrams).

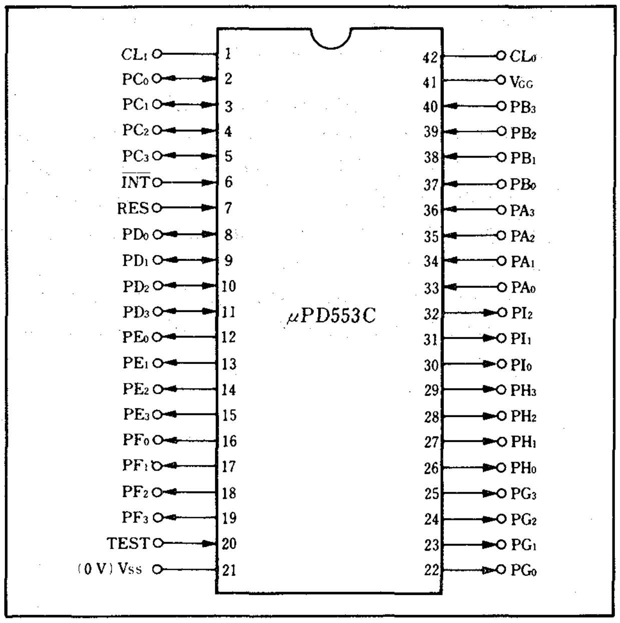
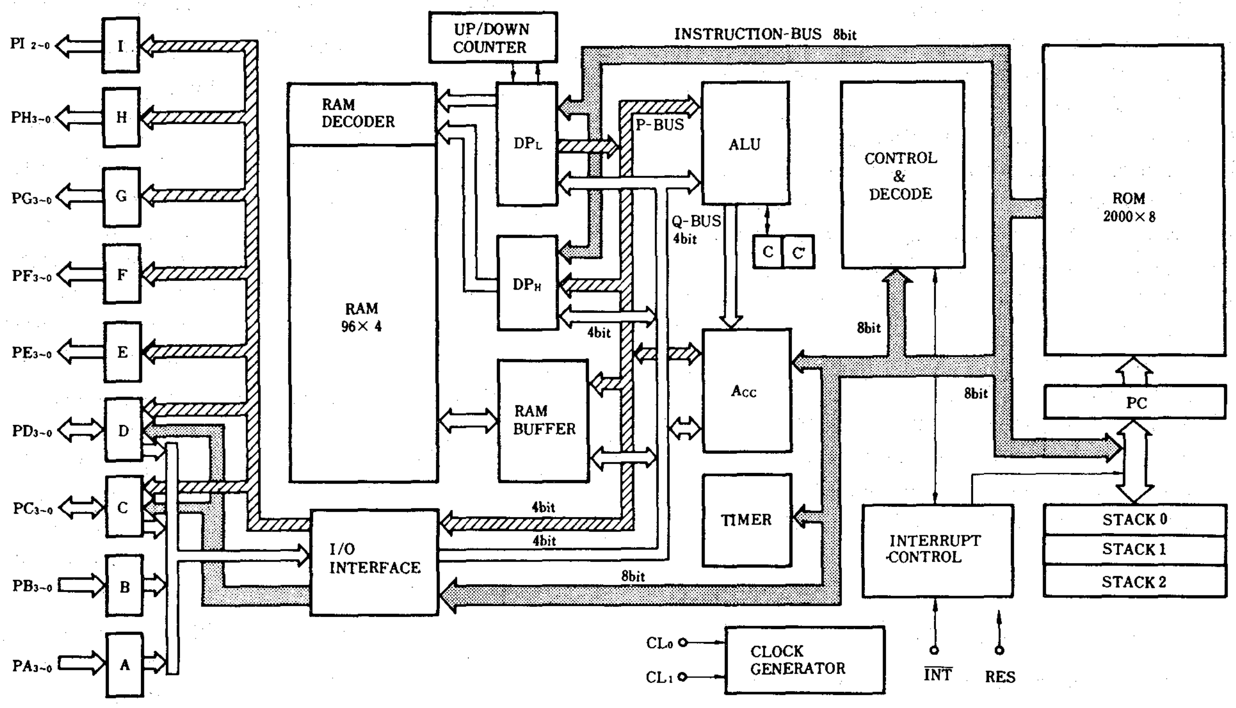

CL1 1
PC0 2
PC1 3
PC2 4
PC3 5
INT 6
RES 7
PD0 8
PD1 9
PD2 10
PD3 11
PE0 12
PE1 13
PE2 14
PE3 15
PF0 16
PF1 17
PF2 18
PF3 19
TEST 20
(0 V) Vss 21
42 CL0
41 VGG
40 PB3
39 PB2
38 PB1
37 PB0
36 PA3
35 PA2
34 PA1
33 PA0
32 PI2
31 PI1
30 PI0
29 PH3
28 PH2
27 PH1
26 PH0
25 PG3
24 PG2
23 PG1
22 PG0
μPD553C

Fig. 3-34 μPD553C

Terminals	Input/Output	Functions
$\overline{INT}$	Input	Interrupt call input.
RES	Input	Reset input.
$PA_{3\sim0}$	Inputs	Input ports $A_{3\sim0}$. 4 bit input and bit test.
$PC_{3\sim0}$	Input/output	Input/output ports $C_{3\sim0}$ During input: 4 bit input and bit test. During output: 4 bit output and immediate data output.
$PD_{3\sim0}$	Input/output	Input/output ports $D_{3\sim0}$. During input: 4 bit input and bit test. During output: 4 bit output and immediate data output.
$PE_{3\sim0}$	Outputs	Output ports $E_{3\sim0}$. 4 bit output, and bit set and reset.
$PF_{3\sim0}$	Outputs	Output ports $F_{3\sim0}$. 4 bit output, and bit set and reset.
$PG_{3\sim0}$	Outputs	Output ports $G_{3\sim0}$. 4 bit output, and bit set and reset.
$PH_{3\sim0}$	Outputs	Output ports $H_{3\sim0}$. 4 bit output, and bit set and reset.
$PI_{2\sim0}$	Outputs	Output ports $I_{2\sim0}$. 3 bit output, and bit set and reset.
$CL_{1\sim0}$	–	For connecting an external LC resonance circuit (IFT, etc.) for the internal clock oscillator.
TEST	Input	LSI test input. Normally connect to Vss (0 V).

1 machine cycle = 4 clock cycles
1 instruction cycle = 1 to 4 machine cycles
Clock osc. = 400 kHz


PI 2~0
PH3~0
PG3~0
PF3~0
PE3~0
PD3~0
PC3~0
PB3~0
PA3~0
I
H
G
F
E
D
C
B
A
UP/DOWN COUNTER
INSTRUCTION-BUS 8bit
RAM DECODER
RAM 96× 4
DPL
DPH
RAM BUFFER
P-BUS
Q-BUS 4bit
ALU
C
C'
CONTROL & DECODE
ROM 2000× 8
Acc
8bit
8bit
4bit
PC
STACK 0
STACK 1
STACK 2
TIMER
INTERRUPT CONTROL
I/O INTERFACE
4bit
4bit
8bit
CL0
CL1
CLOCK GENERATOR
INT
RES

DP : Data pointer
ALU : Arithmetic logic unit
Acc : Accumulator
PC : Program counter
C : Carry flipflop
C′ : Carry hold flipflop

1 machine cycle = 4 clock cycles
1 instruction cycle = 1 to 4 machine cycles

Fig. 3-35 μPD 553C Black diagram

2. Internal System Composition

1) Program counter (PC)

The program counter is composed of a 3 bit register and an 8 bit counter. It functions to address programs contained in the ROM. The 3 bit register specifies the field, the upper 2 bits of the 8 bit binary counter indicate the page, and the lower 6 bits the address. The ROM contains 8 fields; each field consists of 4 pages and each page of 64 addresses (See Fig. 3-36.)

When each instruction is executed, the program counter increments (with the exception of such instructions as jump and subroutine, and those which alter the counter contents). The jump instruction JMP can be used to access all addresses of the ROM. However, the JCP instruction can jump only to an address of the current page. In order to jump to an address of another field or another page, the JMP or CAL instructions are used. By the JPA instruction, a segment of the program counter can be jumped to an address stored in the accumlator (Acc).

Since page and address are specified by a single binary counter, if within the same field the address reaches 63_{10}, 0 of the next page becomes automatically addressed. A different register is used for changing the field and the JMP instruction is employed for this function.

Program counter addressing (ROM addressing) is indicated in Fig. 3-37 in base 16 (hexadecimal) notation.

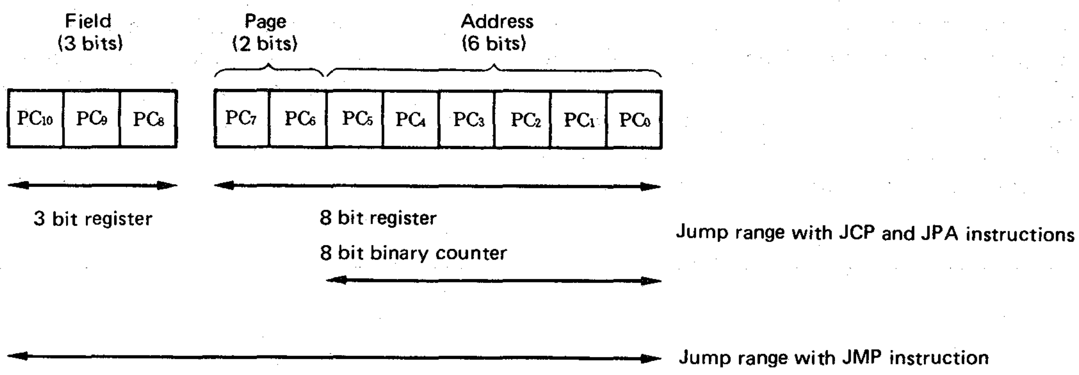
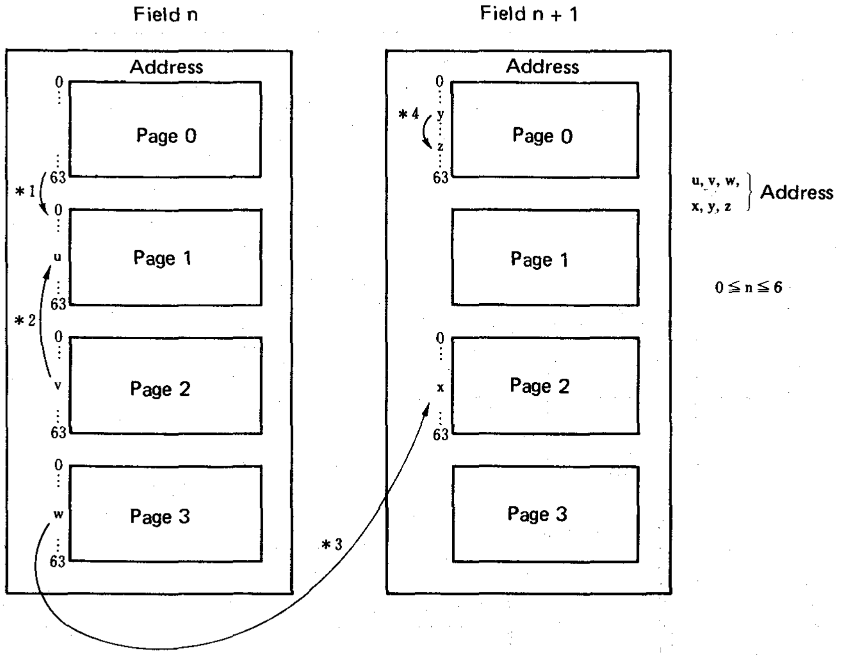

Field
(3 bits)
Page
(2 bits)
Address
(6 bits)
PC10
PC9
PC8
PC7
PC6
PC5
PC4
PC3
PC2
PC1
PC0
3 bit register
8 bit register
8 bit binary counter
Jump range with JCP and JPA instructions
Jump range with JMP instruction

Fig. 3-36 Program counter (PC) composition


Field n
Field n + 1
Address
Address
Page 0
Page 1
Page 2
Page 3
Page 0
Page 1
Page 2
Page 3
0
63
u
v
w
x
y
z
*1
*2
*3
*4
u, v, w,
x, y, z
Address
0≦n≦6

*1 : Automatic jump to address 0 of the next page at increment.
*2 : Jump to another page address with JMP instruction.
*3 : Jump to another field address with JMP instruction.
*4 : Jump to an address of the same page with JCP instruction.
(also with JMP instruction)

Fig. 3-37 ROM addressing

2) Stack register

This 3 x 11 bit register is employed for storing program counter data during subroutine call or interrupt. The stack stores program counter data during execution of CZP and CAL instructions, then returns them with the RT and RTS instructions.

Stack depth is 3 levels, all of which can be used for subroutine call. However, if 1 level is used for interrupt, 2 levels become available for subroutine call.

3) Program memory (ROM)

Program storage is performed by a mask ROM consisting of 2000 words x 8 bits. As shown in Fig. , the ROM is comprised of fields, pages and addresses, which are accessed by the program counter. ROM addresses employable by the user are 000 through 7CF (2000 words), i.e.: 7DO (field 7, page 3, address 16) and subsequent are not usable.

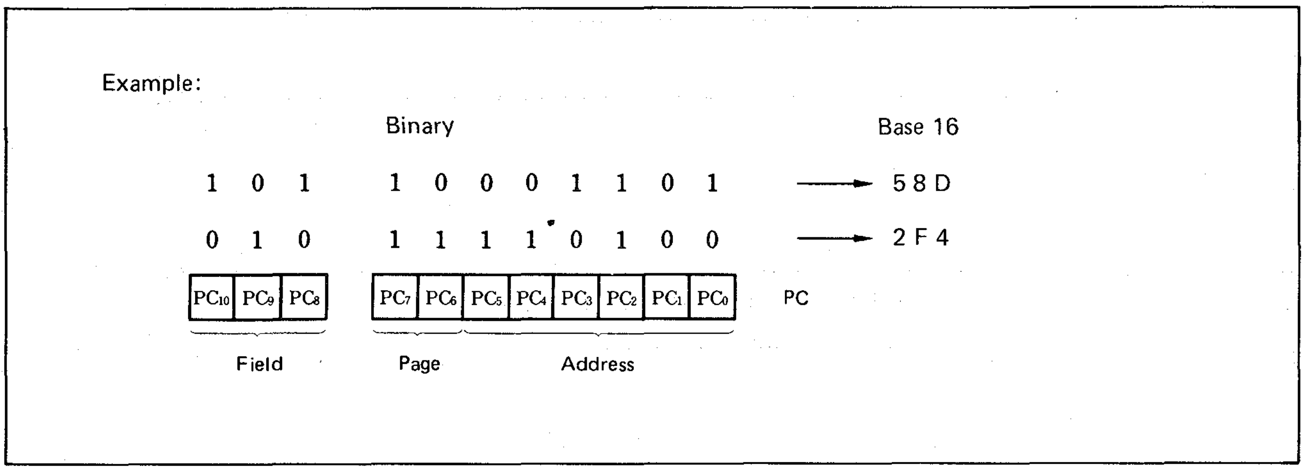

Example:
Binary
Base 16
1 0 1 1 0 0 0 1 1 0 1
58D
0 1 0 1 1 1 1 0 1 0 0
2F4
PC10 PC9 PC8
PC7 PC6 PC5 PC4 PC3 PC2 PC1 PC0
PC
Field
Page
Address

Fig. 3-38

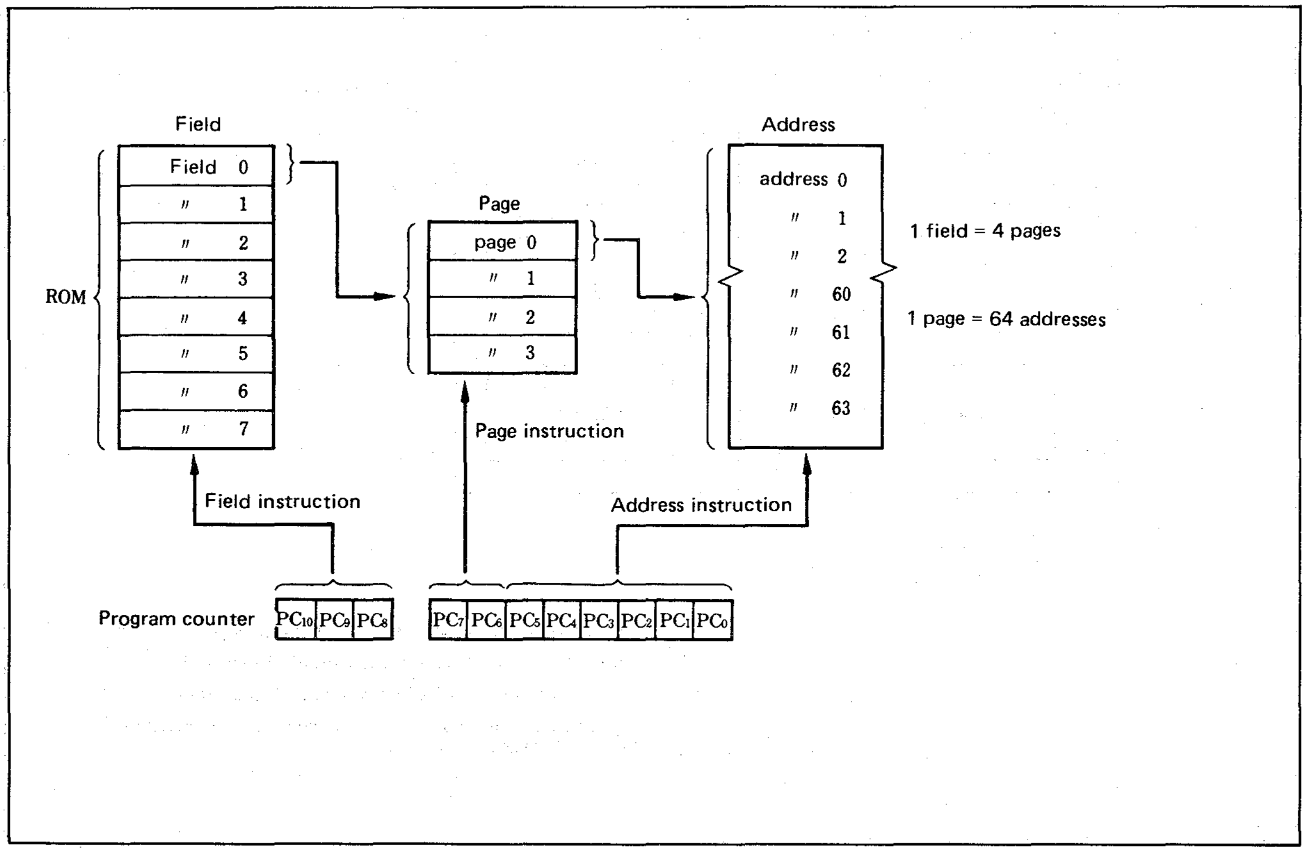

Field
Field 0
〃 1
〃 2
〃 3
〃 4
〃 5
〃 6
〃 7
ROM
Page
page 0
〃 1
〃 2
〃 3
Address
address 0
〃 1
〃 2
〃 60
〃 61
〃 62
〃 63
1 field = 4 pages
1 page = 64 addresses
Field instruction
Page instruction
Address instruction
Program counter
PC10 PC9 PC8
PC7 PC6 PC5 PC4 PC3 PC2 PC1 PC0

Fig. 3-39 ROM and program counter relationship

4) Data pointer (DP)

The data pointer is a register for indicating the data memory (RAM) address. The 7 bit register consists of 3 upper bits (DPH) and 4 lower bits (DPL).

DPH specifies the RAM row address. By utilizing a portion (M_1 and M_0) of LM, XM, XMD and XMI instructions, the lower two bits of DPH can be modified for exclusive-OR.

DPL specifies the column address of the RAM. Since DPL is composed of an up/down counter, it includes increment and decrement functions. Data are incremented during the execution of XI, XMI and IND instructions, and when DPL = 0, skip becomes performed. Conversely, the data are decremented with the execution of XD, XMD and DED, and skip occurs when DPL = F.

By appropriate instructions, data can be transferred between DPH and working registers X and R, and between DPH and working registers Y and S. Data pointer instructions TAL and TLA provide data transfer between DPL and Acc. Immediate data can be loaded into DP by instructions LDI and LDZ. The CLI instruction provides skip when DPL and immediate data are equal. During execution of input/output instructions (OP, IP, etc.), DPL is used for specifying the input/output port.

5) Data memory (RAM)

A 96 x 4 bit static RAM is used for data storage. Address row 7 column 9 is a flag, while A to F of row 7 are working registers. These can also be used for general data storage. The data pointer addresses the memory, with DPH for row address and DPL for column address.

By operating instructions, binary addition and exclusive-OR operations can be performed between the data memory and Acc. Data transfer between the data memory and Acc is accomplished by the load store command. Bit operating instructions can provide set, reset and test for specified bits in the data memory. When CMB and CM instructions are employed, data of the data memory and Acc are compared and skip performed if these are equal.

The INM instruction increments data in the data memory, with skip performed at 0. Similarly, DEM decrements the data memory, with skip at F.

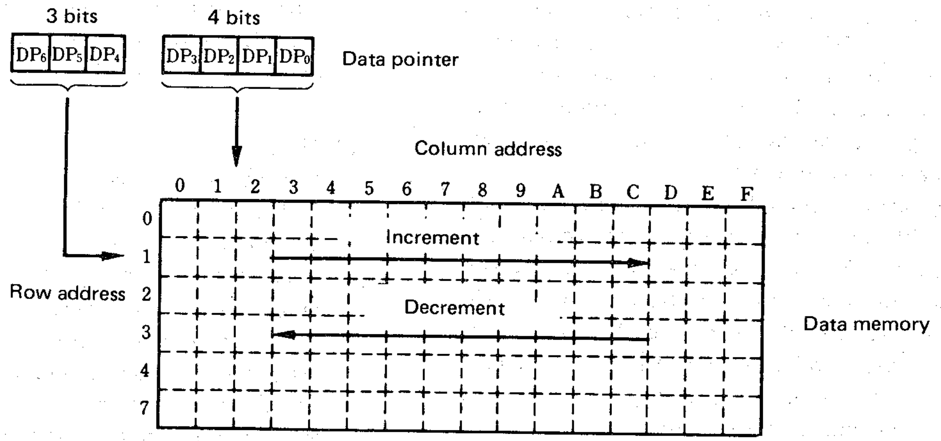

3 bits
4 bits
DP6
DP5
DP4
DP3
DP2
DP1
DP0
Data pointer
Column address
0 1 2 3 4 5 6 7 8 9 A B C D E F
0
1
2
3
4
7
Row address
Increment
Decrement
Data memory

Fig. 3-40 Data pointer and data memory

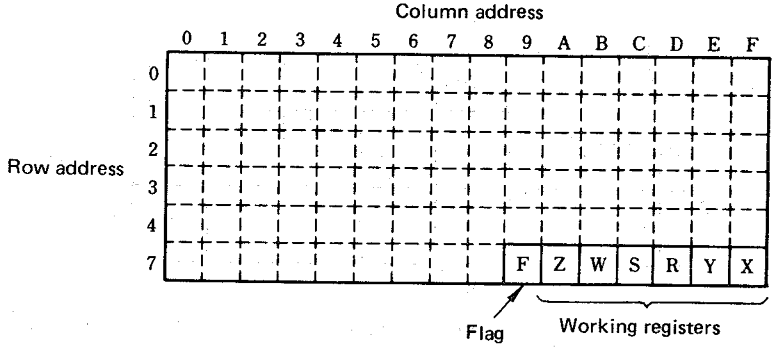

Column address
0 1 2 3 4 5 6 7 8 9 A B C D E F
0
1
2
3
4
7
Row address
F
Z
W
S
R
Y
X
Flag
Working registers

Fig. 3-41 Data memory (RAM)

6) ALU and accumulator

The Acc is a 4 bit register which stores calculation results and processed data. The Acc, together with the ALU, which possesses arithmetic and decision functions, and the carry flipflop, which stores carry and borrow, form the central structure of the microcomputer.

Functions of the ALU include binary addition, increment (+1), decrement (−1), exclusive-OR (EXOR), decimal correction (+6 and +10), comparison, bit test and complement. Binary add instructions are AD, ADS and ADC. Subtraction is performed by complementing in the program. The instructions DAA and DAS are employed for decimal system addition and subtraction, while ECL is used for exclusive-OR operations.

Accumulator data are incremented with the INC instruction and when Acc = 0, carry is produced and skip performed. Similarly, with the DEC instruction, Acc data are decremented and at Acc = F, borrow is produced and skip is performed.

RAR provides right rotation of the Acc data together with the carry FF data. The load store instruction is used for data load, store and transfer between the Acc and the data memory area addressed by the DP. Data transfer between the Acc and DP$_L$ is performed by data pointer operating instructions, and between Acc and working registers Z and W by working register operating instructions. The L1 instruction loads immediate data into the Acc.

Acc bit test is executed with the instruction TAB. The CMB instruction provides bit comparison between the Acc and data memory, and by employing the comparison instruction CM, skip becomes performed when the Acc and data memory data addressed by the DP are equal. Similarly, instruction C1 provides skip when the Acc and immediate data are equal.

Input/output instructions can apply external data to the Acc via the input ports or route Acc data externally via the output ports. Since a carry storage flipflop is provided, carry FF data can be held during interrupt by the instruction XC. The TC instruction tests the carry FF.

7) Flags

The 4 bits at address 79 of the data memory are included as flags. These can be directly addressed by flag operating instructions. SFB and RFB set and reset the specified flag, while FBT and FBF provide test and skip for the specified flag.

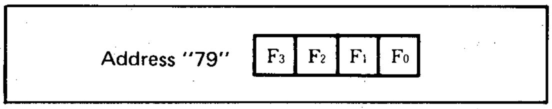


Fig. 3-42

8) Working registers (WR)

6 x 4 bits are provided as working registers at data memory addresses 7A through 7F. These can be addressed directly by working register instructions. Data of working registers X, Y and R can be exchanged with DP by using working register instructions. Likewise, data can be exchanged between working registers Z and W, and Acc. In other words, the working registers can be used to hold DP and Acc data during interrupt and as temporary stores for Acc data during computation.

9) Timer

The internal programmable timer is comprised of a 12 bit register. According to the contents of the 6 bit immediate data component (I_5 to I_0) of the timer setting instruction STM, 64 methods of timer setting are available. As shown in Table 3-5, in conjunction with a clock frequency of 400 kHz, the time can be set from 630 µsec to 40.32 msec. The timer can also be employed as reference in combination with the data memory to provide additional expansion of the count times.

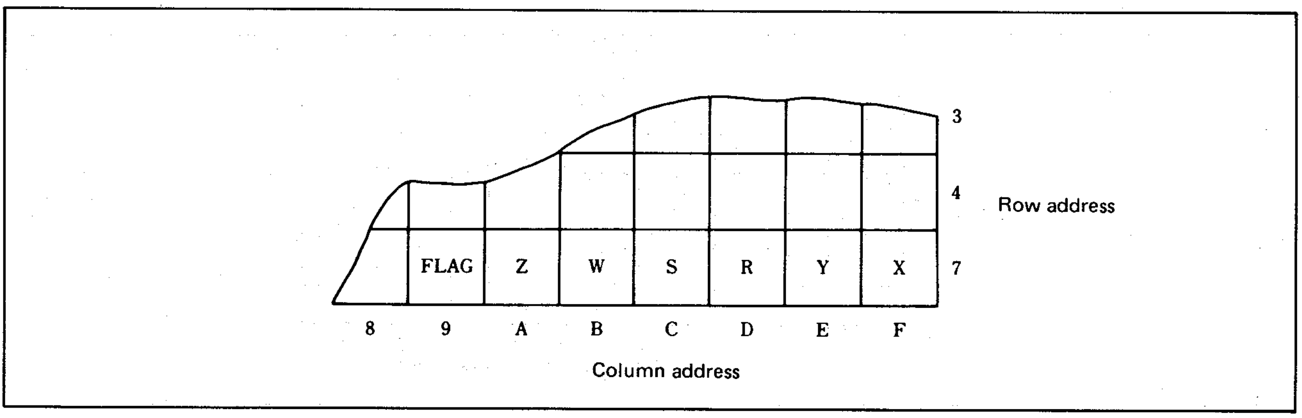


Fig. 3-43 Working register locations in RAM

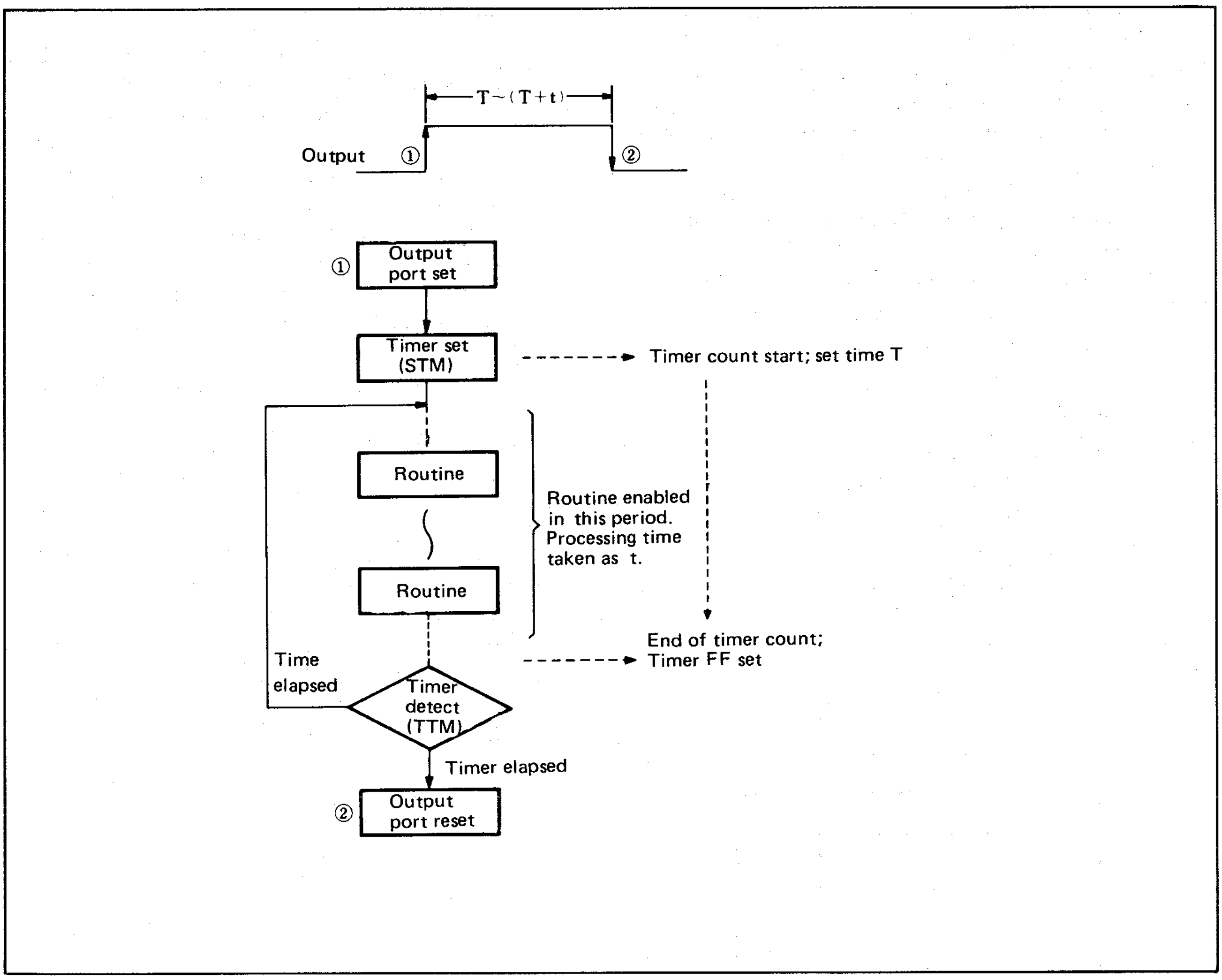

T~(T+t)
Output ①
②
① Output port set
Timer set (STM)
Timer count start; set time T
Routine
Routine
Routine enabled in this period. Processing time taken as t.
End of timer count; Timer FF set
Time elapsed
Timer detect (TTM)
Timer elapsed
② Output port reset

Fig. 3-44 Timer example (timer regulated pulse output)

Immediate data							Set time (ms)
I	I_5	I_4	I_3	I_2	I_1	I_0	
0	0	0	0	0	0	0	0.63
1	0	0	0	0	0	1	1.26
2	0	0	0	0	1	0	1.89
3	0	0	0	0	1	1	2.52
⌇			⌇				⌇
61	1	1	1	1	0	1	39.06
62	1	1	1	1	1	0	39.69
63	1	1	1	1	1	1	40.32

STM immediate data and timer (with 400 kHz clock frequency)

Table 3-5

After setting by the STM instruction, when the set time elapses, the timer FF becomes set. The timer test instruction TTM tests this set output and confirms that the specified time has elapsed. Since an internal timer circuit is included, program processing can be performed in parallel with the timer count. An illustration of the timer operation is shown in Fig. 3-45. In this case, note deviations in the actual pulse width T ∿ (T ∿ t).

The built-in timer eliminates the need for an external timer circuit or a pure software timer. Setting of the timer can also be performed easily without burdening the program.

Set time calculation

*When clock frequency = 400 kHz:
Set time = 0.63 (I + 1) (ms)
I = Immediate data decimal value

*When clock frequency = f kHz:
Set time = $252 \frac{I+1}{f}$ (ms)

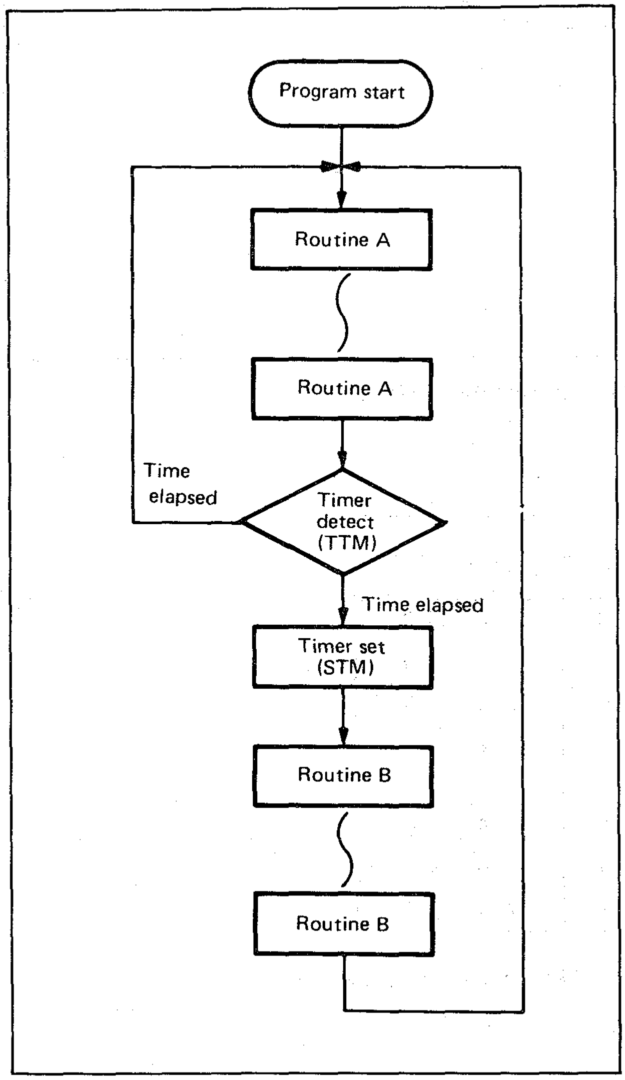


Fig. 3-45

Timer usage note:

It is important to first execute the STM instruction before TTM. If performed in the opposite sequence, in a program such as shown in Fig. , the routine following the TTM instruction may become omitted. This is due to the unpredictable state of the timer FF (which determines skip at TTM) when power is initially supplied. Therefore, in the program shown, if the timer FF is set at power on, both routines A and B will be executed, but if not set, routine B will become omitted.

The timer count data affect the timer FF from the point STM is executed. Consequently, the TTM instruction must be executed after the STM instruction.

10) Input/output ports

Nine input/output ports (A to I) are provided. Each is composed of 4 bits, except for I, which has 3 bits. The ports are addressed by DP$_L$ and a 2 bit instruction (B_1 and B_0) addresses bits within ports. Input/output instructions include several which address ports independently of DP$_L$ (IA, OE, etc.).

Port Type	Port Designations
Input (4 bits)	A, B
Input/output (4 bits)	C, D
Output (4 bits)	E, F, G, H, I*

*Port I is 3 bits.

Interrupt functions

Input $\overline{INT}$ is connected internally to the interrupt flipflop (INT FF). This FF becomes set when an interrupt call signal at 0 level is applied to the input for at least 8 clock cycles. At this time, if the interrupt enable flipflop (INTE FF) is set, the interrupt mode becomes obtained after completion of the instruction in progress. If the INTE FF is reset, the EI instruction performs setting and the interrupt mode can be entered after completion of the next instruction. (INTE FF is set by EI and reset by DI.)

At least 8 clock cycles at level "1" are required between interrupt call signals.

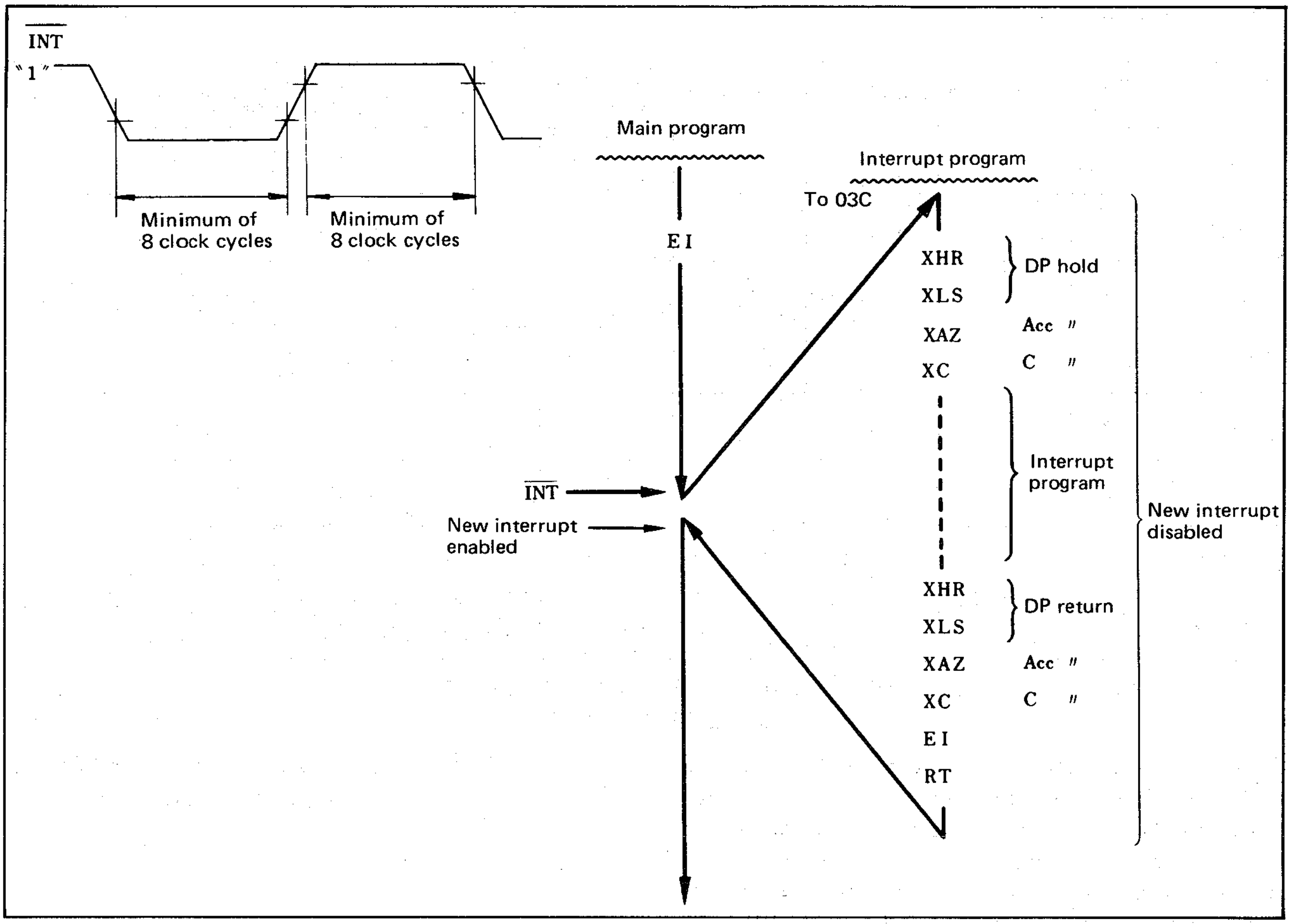

INT
"1"
Minimum of 8 clock cycles
Minimum of 8 clock cycles
Main program
Interrupt program
To 03C
E I
XHR
XLS
DP hold
XAZ
Acc ″
XC
C ″
Interrupt program
New interrupt disabled
INT
New interrupt enabled
XHR
XLS
DP return
XAZ
Acc ″
XC
C ″
E I
RT

Fig. 3-46 Interrupt flowchart

Reset functions

By employing an external reset circuit (Fig.), the microcomputer can be reset by applying "1" to the RES input. At reset, 000 (field 0, page 0, address 0) is loaded in the program counter. Jump is performed to this location, INT FF and INTE FF are reset and interrupt disabled. Also, open drain transistors of ports C through I are off (Fig. 3-48). A minimum of four machine cycles are required for the RES input.

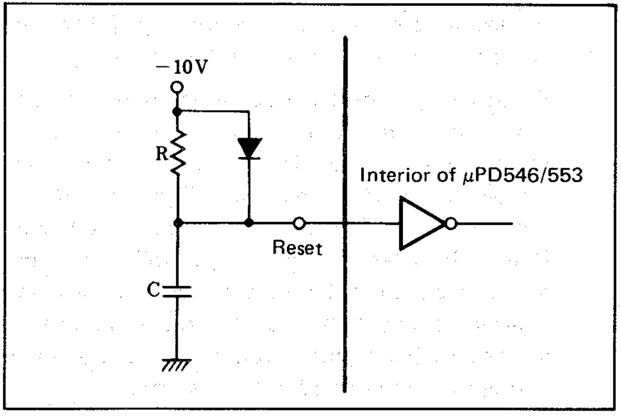

−10V
R
C
Reset
Interior of μPD546/553

Fig. 3-47 External reset circuit example

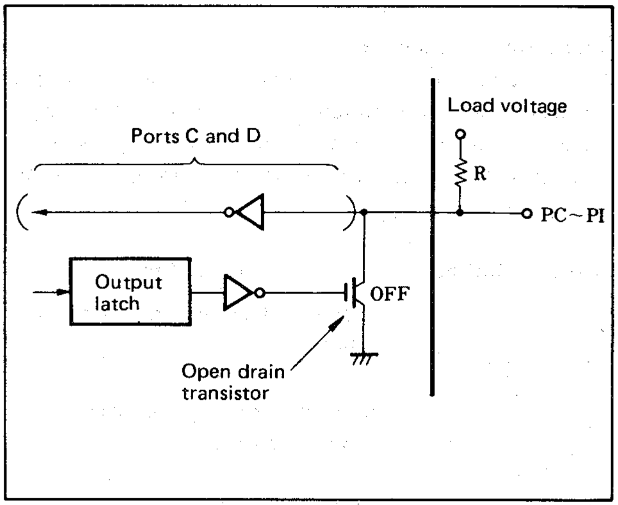

Load voltage
Ports C and D
R
PC~PI
Output latch
OFF
Open drain transistor

Fig. 3-48 Transistor states at reset

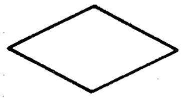
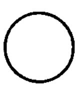
3.2.7 Mechacon function

	Power ON	Cassette IN	STOP	Loading	REC PLAY	S-REW	S-F.F	REC PAUSE		STILL	X2 Speed	SLOW	Frame Advance	Un-loading	REW	FF	EJECT
								S-REW	PAUSE								
Cassette motor	0.3 sec ON	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O
Loading motor	X	X	X	O	X	X	X	X	X	X	X	X	X	O Reverse	X	X	X
Reel drive motor	X	X	X	X	O PLAY Rotation	O S-REW Rotation	O S-FF Rotation	O S-REW Rotation	X	O	O	O	O	O Unloading Rotation	O REW Rotation	O F. F. Rotation	X
Capstan motor	X	X	X	O	O	O	O	O	O	X	X 2 Speed	SLOW	Frame advance	O	X	X	X
Drum motor	X	X	X	O	O	O	O	O	O	O	O	O	O	O	X	X	X
Pinch roller sol.	X	X	X	X	O	X	X	X	X	O	O	O	O	X	X	X	X
Brake Sol.	X	X	X	O	O	※1	※2	※1	OFF	O	O	O	O	O	O	O	X
Function L.E.D	0.3 sec EJECT ON	STOP Δ	STOP O	PLAY Δ	PLAY O REC O	PLAY O	PLAY O	REC O PAUSE O PLAY O		PLAY O STILL O	PLAY O SPEED O	PLAY O SLOW O	PLAY O STILL O	STOP, REW FF, EJECT Δ	REW O	FF O	EJECT Δ

Table 3-6 ※1 Initial and End of S-REW ON→ OFF → ON
※2 End of S-FF ON → OFF → ON

A program is the set of instructions written into the ROM. In effect, it tells the computer what to do with the input data and how to react in event of various contingencies. The program is best understood when expressed in the form of a "flowchart" (or "algorithm"), which lists the steps in the order they are to be performed. The μcom proceeds automatically from each step to the next.

Interpreting a Flowchart:
The symbols used in a flowchart are more or less standardized. As can be noted, each step is outlined by a particular shape. The shape of the outline indicates the type of operation to be performed. These are described briefly below.

Shape of Outline	**Type of Step**
	: Process: indicates a processing function.
	: Decision: refers to a decision or switch operation.
	: Predefined process: the computer is to perform a subroutine or other predetermined set of operations before proceeding to the next step.
	: Connection: an output from or an input to a point external to the flowchart.
	: Terminal: flowchart terminal indicating start, stop, delay, pause, etc.

Flowcharts for Mechacon Routines:

1. **START** (Refer to section 3.2.8-1.)
   When power is first supplied, the initial START routine is performed, after which modes such as Stop, Loading and Unloading become enabled. The All Output Clear subroutine clears all internal memories, flags and outputs. Enable interrupt (EI) sets the enable flipflop, permitting acceptance of an interrupt request.

   CASSETTE SW ON? checks the on/off state of the cassette switch. If on, the lamp failure contingency is checked, then the cassette motor rotates in the loading direction for 300 msec. This operation is shown in the flowcharts.

   At BRAKE, a short period timer subroutine sets a 300 msec timer. During this period, the (—) side of the cassette motor is energized and the motor rotates in the loading direction. The rotation continues until TIME detects the elapse of 300 msec. Due to hysteresis, there is a possibility that the microswitch may be closed even though the cassette is not fully seated. This possibility is avoided by having the motor rotate for 300 msec in order to firmly position the cassette.

In the START X routine, if the timer switch is off, the normal Stop mode is entered. If the timer switch is on and the timer mode set, the record safety switch is polled, after which the timer record or timer play mode becomes entered.

With the cassette switch off, or in case of lamp failure, the START-2 routine is performed and the Eject mode entered. If the cassette switch is not depressed at the initial supply of power, the Eject mode becomes entered unconditionally.

The following table shows the relationship between the cassette switch and detector.

	Cassette Switch	Cassette Detector
Stop Mode	Off	Lighted (off)
Cassette Loading Start	Off	Darkened (on)
Cassette Loading	Off	Lighted (off)
Cassette Loaded	On	Lighted (off)
During EJECT	Off	Darkened (on)

As can be noted from the table, the cassette detector is on (light cut off) with a cassette loaded in the cassette housing and during the EJECT process, During Eject, undulation of the chain may alternately switch the cassette detector on/off. For this reason, a subtimer operates and repeated on/off within 300 msec is not detcted.

After subtimer decrement, AOCL clears all outputs, memories and flags. A warning (EJECT Lamp) flashes in event of lamp failure. If the lamp is normal, the unloading switch, cassette switch and cassette detector are polled, then the Eject mode is entered. This completes the initial start program.

2. **STOP** (Refer to section 3.2.8-2.)
Via initial start, the STOP routine is entered unconditionally in modes other than timer rec and timer play. It is also entered unconditionally when the cassette switch is depressed at completion of cassette load. The STOP ON subroutine addresses the stop memory and produces the stop lamp output.

   In STOP-2, a 200 msec timer is set when changing from FF or REW to another mode, and when shifting from unloading to Play, FF, REW, and Eject. The 200 msec Stop mode compensates for the direct operation feature of this mode. After the mechanisms have entered the Stop mode, the next selected mode is obtained.

   Polling continues with the UNLOADING OFF, SENSOR and MODE SW subroutines, then to the Eject and Play modes. Time is tested and the LAMP FLAG OFF instruction stops the lamp flashing, then FF and REW modes are polled.

3. **CASSETTE LOAD** (Refer to subsection 3.2.8-3.)
In this routine, the cassette motor rotates in the loading direction and the stop lamp flashes. The overtime timer is set for 5 seconds and the Eject mode polled.

   The motor continues to rotate until the cassette switch closes. However, if this does not occur within 5 seconds, the motor rotation is stopped and the START-2 routine entered. In other words, in event the cassette switch does not become on within 5 seconds, the START-2 routine produces the Eject mode.

4. **INTERRUPT** (Refer to section 3.2.8-4.)
This routine polls input port A2 (IC1 pin 35). The states of input port A2, REC safety, counter and unloading switches, and mode signal input D2 are checked.

   D2 is low (binary "0") in modes other than Stop and Eject (Slow and X2 are taken as forms of the Play mode). If A2 = 0, the machine is set for a mode other than Stop or Eject. AOCL then clears all outputs, memories and flags. In order to check that AOCL has cleared these locations, output rotation is performed and outputs are produced from ports C thorugh I.

   A2 = 0 is again checked and if A2 equals zero, this subroutine repeats until it does not. A2 ≠ 0 is interpreted as Stop or Eject, and the program enters the START routine.

   If A2 = 1 at first, the machine is set for a STOP or EJECT mode.

   Tape guard and lamp states are polled and, if normal, the return (RT) instruction is executed.

5. **REWIND** (Refer to section 3.2.8-5.)
Brake solenoids 1 and 2 are activated in the Rewind mode from voltage supplied to coils 1 and 2. The reel motor rotates in reverse in the "idler" mode, which positions the idler between the supply reel disk and the reel motor. A timer controls the rotation for about 140 msec and the tape counter set for counts down.

SENSOR, TAPE END-1, REPEAT, SEARCH and MODE switches are polled. If light strikes tape start sensor, the REPEAT switch is polled and if the selected mode is other than repeat, the Stop mode is entered and rewind stops.

If the REPEAT switch is on, flag-3 (slow repeat) and flag-4 (speed X2 repeat) are polled. When either of these flags is on, the Slow or Speed playback mode is entered.

When no light strikes tape end sensor-1, the REPEAT switch is polled and if on, the CUE switch is polled. With this latter switch on, the cue signal is detected and the Normal, Slow or Speed Repeat mode entered.

Brake solenoid-2 is de-energized when coil-2 goes low, cutting off the brake solenoid holding circuit. At this time, the reel motor switches from idler to rewind rotation, thus beginning the Rewind mode.

6. **FAST FORWARD** (Refer to section 3.2.8-6.)
In the same manner as the Rewind mode, brake solenoids 1 and 2 are on, activating the solenoid. The reel motor with idler drive turns for 150 msec in the forward direction, which shifts the idler toward the take-up reel disk. The timer is set for 140 msec and the tape counter performs count-up.

SENSOR, SEARCH and MODE SW are polled and FF confirmed. If the FF mode has been set, time is detected and brake solenoid-2 switches off. The reel motor rotates in the FF mode. From this point, the brake solenoid is switched to the holding circuit.

7. **LOADING** (Refer to section 3.2.8-7.)
A 220msec timer is set and LOADING-3 executed. The LAMP FLAG ON instruction flashes the play lamp, then the SENSOR and MODE SW routines are polled. After time detection, flag-7 (ON during Play; OFF during Stop, Loading, Unloading and Brake) is switched off.

During the 150 msec timer interval, the NEW LOADING subroutine is polled. Brake solenoids 1 and 2 switch on and the reel motor rotates forward in the idler mode. The idler shifts to the take-up reel disk. The tape counter counts up and the SENSOR and MODE SW subroutines are polled.

The timer is set for 6.5 seconds, flag-7 switched off (off during Loading), brake solenoid-2 off, and the solenoid is switched to the holding circuit. After checking the NEW LOADING routine, the reel motor stops and the loading motor rotates in the loading direction to begin Loading. The SENSOR and MODE SW subroutines are polled and time detected. This loop continues for 6.5 seconds.

If the loop continues for more than 6.5 seconds, the CPU detects overtime and the machine goes to the Stop mode (Unloading begins).

However, if the loop ends within 6.5 seconds, the NEW LOADING subroutine checks the AL switch, polls the Play mode and sets flag-7 on and proceeds to the PRE PLAY routine. From this point, the loading motor switches off, lamp flag off, and loading completes to provide the Play mode.

8. **UNLOADING** (Refer to section 3.2.8-8.)
In the UNLOADING routine, the lamp flag flashes the stop lamp, then UNLOADING OFF, SENSOR and MODE SW subroutines are polled. The UNLOADING OFF subroutine sets brake solenoids 1 and 2 off, reel motor off, flag-7 off, cassette motor off, loading motor off, pinch roller solenoid off, cue signal off and REC off. Time is then detected and UNLOADING X routine executed.

The 6.5 second overtime timer is set and the NEW UNLOADING subroutine polled. In the UNLOADING-7 routine, brake solenoids 1 and 2 again become on, the loading motor rotates in the unloading direction, tape counter counts up, and the reel motor rotates in the unloading direction to begin unloading.

If unloading is not completed within 6.5 seconds, the UNLOADING OVERTIME routine produces the Stop mode. In practice, unloading requires about 3.5 seconds and in the NEW UNLOADING subroutine, if the UL switch is on, the program proceeds to the Stop mode.

9. **PLAY** (Refer to section 3.2.8-9.)
Brake solenoids 1 and 2 are on at the completion of loading in the normal Play mode. At PLAY-2, the pinch roller solenoids 1 and 2 are energized and the REC mode polled. If recording, the program proceeds to REC-2.

In the PLAY-6 routine, a 1 second timer is set. The tape runs for 1 second in the Play mode in order to stabilize the transport, and Search REW and Search FF modes are inhibited. Flag-8 is on during this time.

The tape counter counts up in the PLAY X routine, at which time REC/STOP 12 V is off, the reel motor rotates in the Play mode and REC OFF is checked. Afterwards, SENSOR, AF-REC, REPEAT, FLAG-7 ON, S-REW END, and MODE SW are polled, then PLAY Z entered.

At S-REW END, flag-5 (edit flag) is off and S-FF mode checked. Therefore, S-FF can be entered directly from the Play mode. In the PLAY Z routine, time is detected and in a 1 second period, the PLAY X routine is polled. After 1 second, the brake solenoids and pinch roller solenoid 2 are switched off, and the solenoid holding circuit cut off.

Tape end sensor-1 is polled, flag 8 set to on and the STILL switch checked. Afterwards, the PLAY routine continues.

10. STILL (Refer to section 3.2.8-10.)
The normal Still mode is produced when light strikes tape start sensor during the S-REW mode. It is also entered when the STILL switch is pressed in the AF-REC mode, and in the S-FF mode when light strikes tape end sensor.

Excessive continuation of the Still mode is avoided by including an approx. 7 minute timer, which serves to protect the video heads and tape. After polling the SENSOR subroutine, the AF-REC mode is detected. If this mode has been selected, flag-9 goes on, the MODE SW subroutine is polled, then the main routine returned.

If not AF-REC, the S-REW END subroutine and S-FF mode are polled. With S-FF on, flag-6 is switched off. This flag functions when tape start sensor operates and the Still mode is entered.

When the S-FF mode has not been selected, MODE SW, RT and OVERTIME are polled. If the Still mode has continued for more than 7 minutes, TAPE END is polled and Stop or Rewind addressed.

The Still mode is obtained at the tape end during the S-FF mode. After 7 minutes elapse, the OVERTIME instruction produces the Stop mode, after which the Rewind mode is automatically entered.

11. SEARCH REWIND (S-REW) (Refer to section 3.2.8-11.)
When S-REW is selected from the Play mode, pinch roller and brake solenoids switch off and the idler shifts to produce S-REW. This process serves to maintain even tape tension and avoid picture loss or strain on the tape.

The S-REW END subroutine detects the S-REW mode when it is selected during the Play routine. Flag-5 is switched off the S-REW END-2 addressed. If light strikes tape start sensor, the routine proceeds to the Still mode. Also, flag-6 becomes on if the beginning of tape is reached during S-REW. This flag is the Still flag for tape start sensor and, even if the S-REW button is pressed, the Still mode remains held. If a mode other than Still or S-REW is selected, the normal mode is returned.

When no light strikes tape start sensor, flags 5 and 6 are off, and the PINCH ROLLER subroutine is polled. This subroutine sets a 126 msec timer and switches off pinch roller solenoids 1 and 2, CUE and REC. In sequence, the PLAY, REC and S-REW modes are polled, and if the S-REW mode has been selected, time is detected and a 300 msec timer set. This is to minimize picture loss during the transition from Play to S-REW. In other words, the pinch roller solenoid is off, but the brake solenoid on. However, the idler motor continues to take up tape in the Play mode, thus avoiding picture loss due to tape slack.

Return is executed at the RT instruction, then the TRANSFER routine is polled. This is a brake timing routine performed during transfer of the S-REW, Play and S-FF modes. A 200 msec timer is set, brake solenoids switched off, and the idler returns to center. In absence of light at tape end sensor, the Play, REC and AF-REC modes are polled and flag-5 set to on. This is a flag for S-REW during transfer.

A polling sequence covers S-REW END, S-FF, MODE SW, TIME, REC, AF-REC, S-FF, S-REW and TAPE START SENSOR, after which the S-REW routine is addressed. In this routine, the reel motor rotates in the idler mode and the brake solenoids switch on. The idler shifts from center toward the supply reel disk.

The timer is set for 150 msec and the tape counter counts down. Tape end sensor-1, S-REW and TIME are polled, and brake solenoid-2 set to off. The brake solenoid is switched to the holding circuit and the reel motor rotates at approx. 10 times normal play speed to yield the S-REW mode.

12. SEARCH FAST FORWARD (S-FF) (Refer to section 3.2.8-12.)
This mode can be entered from Play, Slow, S2, Still or S-REW. Brake solenoids 1 and 2 switch on, the reel motor rotates and the idler shifts toward the take-up reel disk.

In practice, the S-FF routine is entered only when switching from S-REW to S-FF. At other times, the S-FF-2 routine is addressed.

Pinch roller solenoids 1 and 2 switch off, the tape counter counts up, then tape end sensor, S-FF and TIME are polled. Brake solenoid is switched off and the holding circuit on. The reel motor then rotates in the S-FF mode.

13. **IDLER** (Refer to section 3.2.8-13.)
The IDLER routine is executed when entering Play, REC, AF-REC, AF-REC Still and Still from the TRANSFER routine. The timer is set for 150 msec, brake solenoids 1 and 2 on, the reel motor rotates in the idler mode, and the tape counter counts up. A polling sequence covers PLAY SENSOR, MODE SW, PLAY, tape end sensor-1, REC, AF-REC, S-REW and TIME. Brake solenoid-2 switches off and the program enters the PRE-PLAY routine.

14. **MODE SWITCH (MODE SW)** (Refer to section 3.2.8-14.)
States of the operation switches are checked by the MODE SW routine. If the Stop switch is pressed, the Stop memory is addressed, and Play and Still/Pause memories inhibited, after which the main routine becomes returned.

If Stop is not pressed, the Play switch is polled. If this is not pressed, the Still/Pause, REC and AF-REC switches are polled. At this time, by simultaneously pressing the Still/Pause and REC (or AF-REC) switches loading is performed and the Pause mode entered. However, this is not produced if the switches are pressed individually. It is also inhibited in absence of the cassette safety tab (REC SAFETY "NO").

A polling sequence covers Still/Pause, Play, REC and AF-REC, and flag-1 (camera input memory) switches on. The Still/Pause, Slow and Speed switches are then polled. The purpose of this sequence is to prevent independent operation of the Still/Pause, Slow and Speed switches. These become enabled only after the Play switch is pressed.

At CAMERA, if a video camera is connected to the 10 pin connector and the camera trigger switch is off, the camera input goes low and the machine enters the Pause mode. In this state, the Pause mode is not released by pressing the Play switch.

The camera input goes high when the trigger switch is pressed, releasing the Pause mode. However, camera Pause is produced only with REC or AF-REC in the camera mode; it is not obtained in other REC and Play modes.

When the Play switch is pressed, a polling sequence covers REC Safety, REC, AF-REC, Slow, Speed, Play, REC and AF-REC. With Still/Pause off, the Still/Pause memory is inhibited. Flag-6 (Still flag for tape end sensor-1) is switched off, Play memory set and return performed to the main routine.

15. **PINCH ROLLER ON → OFF** (Refer to section 3.2.8-15.)
This routine is executed during the transition from Play to Stop mode (i.e., pinch roller solenoid on and tape running). Its purpose is to avoid tape slackening in the area of the pinch roller.

The Stop memory is enabled and after polling PINCH ROLLER, the UNLOADING routine is entered. When the pinch roller separates from the capstan, the reel motor rotates to take up the tape slack, then the unloading process begins.

16. **PINCH ROLLER OFF (PINCH OFF)** (Refer to section 3.2.8-16.)
The PINCH OFF routine is executed at such times as when unloading overtime is reached or Stop is pressed during REC Pause. After enabling the Stop memory, the UNLOADING routine is addressed immediately.

17. **UNLOADING OFF** (Refer to section 3.2.8-17.)
This is performed in the braking period of unloading, loading and Stop. It is also executed in the transfer period between F-FF and tape end. The functions are listed below.

Flags 2 (edit) and 8 (loading) off
REC mode released; Flag 9 (REC) off
REC Stop enabled; REC/Stop power supplied
Flag-6 (Still flag at tape end) off
Brake solenoid off; reel motor off
Flag-7 (Play on flag) off
Cassette motor off; loading motor off
Pinch solenoid off
Cue off; REC off

18. **SEARCH** (Refer to section 3.2.8-18.)
Counter and Cue Search modes can be selected from the front panel. In this routine, the Search switch is polled. If Cue has been selected, the cue signal is detected and the Stop mode entered.

19. **REPEAT** (Refer to section 3.2.8-19.)
Repeat switch is detected. In Counter Repeat, Play continues until the counter reaches 0000 and in absence of light at tape start sensor, the Still/Pause switch and FLAG subroutine are polled, then the Play to REW subroutine is executed. This latter routine enables the REW memory and proceeds to the PINCH subroutine. The UNLOADING routine is then entered.

Repeat Loops
Counter Repeat: Play mode → counter 0000 → unloading → REW → tape start sensor → Play mode

Cue Repeat:	Play mode → tape end sensor/ counter "0000" → unloading → REW → cue signal or tape start sensor → Play mode
Full Repeat:	Play mode → tape end sensor → REW → tape start sensor → Play mode

20. **UNLOADING TO LOADING** (Refer to section 3.2.8-20.)

Pressing Play during unloading initiates loading. However, an abrupt change between these modes could lead to tape damage due to slackening. Consequently, this routine stops the unloading motor for 150 msec, during which the reel motor rotates to take up the tape slack.

21. **SENSOR** (Refer to section 3.2.8-21.)

This routine polls the tape guard, cassette lamp, tape end sensors 1 and 2, etc. in order to detect tape breakage, lamp failure, defective tape winding and incorrect cassette positioning, in which event the Eject mode is entered.

When light strikes tape end sensor-2 at the end of tape, the auto Rewind mode is entered. Rewind continues until the Stop switch is pressed or light strikes tape end sensor-1.

22. **PLAY SENSOR** (Refer to section 3.2.8-22.)

The PLAY SENSOR routine polls the tape status during the Play mode (including Still, REC, X2, Slow, etc.). When light strikes tape end sensors 1 and 2 during Play, tape breakage is interpreted and the PLAY TO EJECT routine produces the Eject mode.

At end of tape during Play, the timer switch is polled and if on, the PLAY TO EJECT routine is addressed. If the timer switch is off, Still/Pause and REC are polled. The FLAG routine switches on the Speed Repeat and Slow Repeat flags, then the PLAY TO REW routine is addressed.

23. **RECORDING (REC)** (Refer to section 3.2.8-23.)

When both REC and Play switches are pressed, this routine produces the cue signal output for 1 second at the start of recording. At this time, flag-2 (edit) is off and Edit inhibited even if the Pause switch is pressed. Edit becomes enabled 1 second later, with flag-2 on and the Pause switch pressed.

The REC-5 routine is addressed at completion of Edit. This routine sets a 1 second timer, counter for count up, flag-9 (REC off input enable) on and REC/Stop on. Tape end sensor-1 and Still/Pause are polled, then REC ON or REC OFF executed. If the Still/Pause switch is pressed, flag-2 (Edit) is checked and REC Pause addressed.

With REC on, PLAY SENSOR and MODE SW are polled, time detected, and brake solenoid-2, pinch solenoid-2 and cue switched off. After polling the Still/Pause switch, flag-2 is switched on.

24. **RECORDING (REC) PAUSE** (Refer to section 3.2.8-24.)

The REC PAUSE mode is entered only when flags 2 and 8 are on. It is thus enabled 1 second after both REC and Pause switches are pressed.

This routine sets a 150 msec timer, polls REC OFF, PLAY SENSOR and MODE SW subroutines, detects time and sets flag-2 on. With flag-2 on, REC PAUSE-9 becomes addressed. This latter routine sets flag-5 (edit over run) off and detects PAL or NTSC. If PAL, the counter is set to "6", brake solenoids 1 and 2 on, reel motor-3 on (S-REW mode), and counter to count-down. Afterwards, PRE ROLL is addressed.

25. **PREROLL (S-REW)** (Refer to section 3.2.8-25.)

This routine counts the recorded control pulse in the S-REW mode. A pulse counter divides the frequency and the rising component of the resulting 50% duty waveform is counted.

The PREROLL routine sets a 300 msec timer, detects control H, and counts the control pulse. At count "16", the REW OFF subroutine is executed. However, in the case of S-REW off, since the possibility of tape over run occurs due to mechanical inertia, flag-5 (preroll over run) is switched on and the control pulse counted for 300 msec. After 300 msec, the switch modes are polled. If Pause mode, Pause continues. If Pause is off, the Edit mode is addressed.

26. **EDIT** (Refer to section 3.2.8-26.)

Pressing the Play switch in the REC Pause mode addresses the EDIT routine. This counts the control pulse in the Play mode and at $6 \times 2 + \alpha$ frame, recording starts.

With the MODE SW in REC/PLAY, the REC OUT routine is entered at completion of the control pulse count. The rise or fall of the drum flipflop pulse is detected and by the timing of either, REC OUT is obtained.

In the case of PAL, the counter control pulse setting is $(16 - 6) \times 2$ + (over run) = 20 frames + (over run). S-REW is executed and REC Pause addressed.

When Play is pressed [16 x 2 + (over run)] – 6 x 2 = 12 + (over run) are counted and REC OUT produced. In other words, S-REW is performed for 20 frames + over run and Play for 12 frames + over run, then the REC mode is entered. Thus, 8 frames of over recording are produced.

Edit becomes enabled in the REC routine when the edit control pulse counter switches flag-2 on. In the REC PAUSE routine, the counter is set to "6". The count continues in Preroll to "16". Thus, S-REW is performed for (16 – 6) x 2 frames.

After 20 frames of S-REW, standby in the Pause mode is obtained.

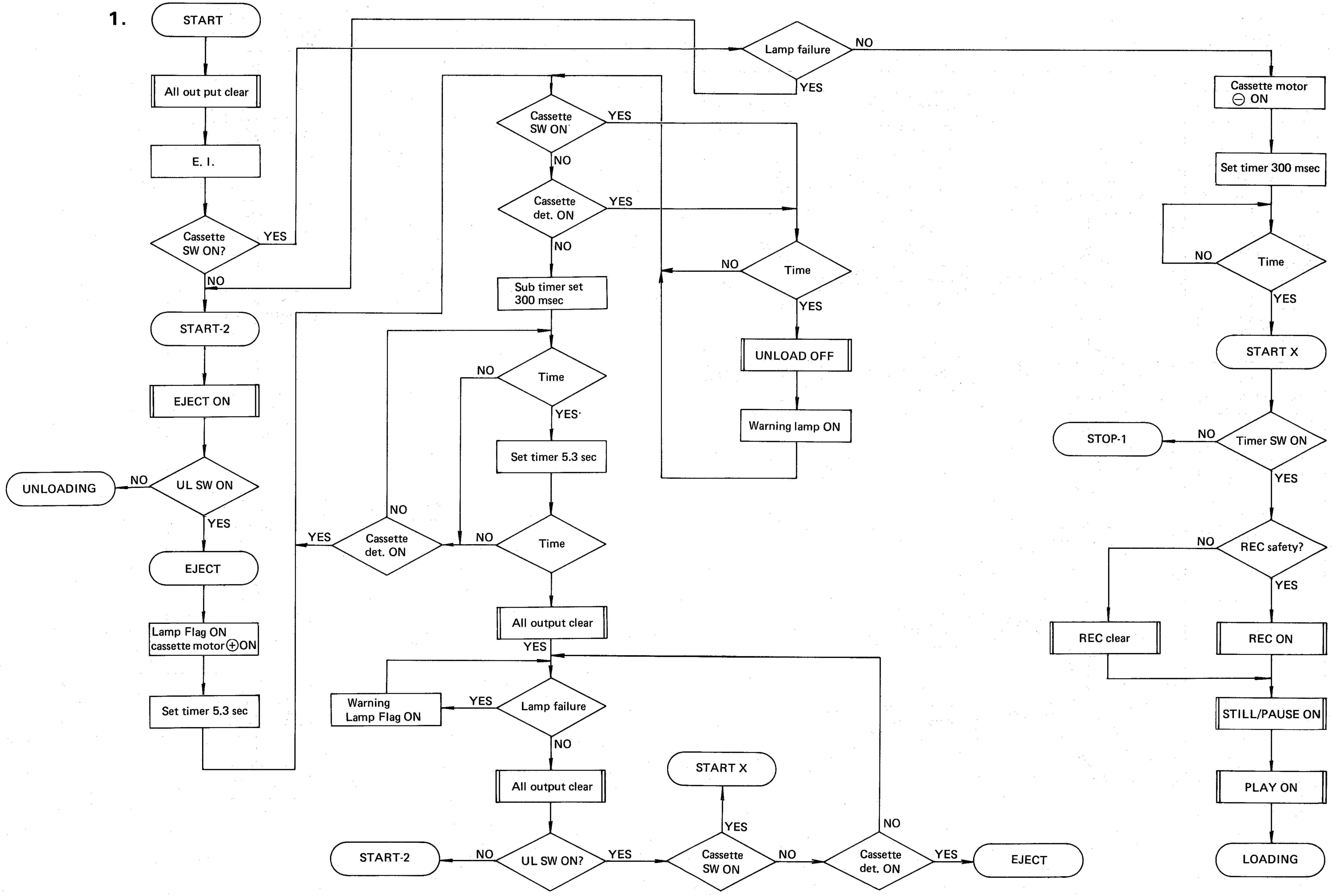
The EDIT routine is entered when Pause is released. Ccount down is performed to "6". Thus, 6 x 2 = 12 frames and 20 – (6 x 2) = 8 frames.

At Still/Pause release, 16 frames are played and REC OUT produced. The rise or fall of the flip-flop waveform is detected and recording starts. Although 8 frames become over recorded, since this amounts to 8/25ths of a second, serious disturbance of the playback picture is avoided.

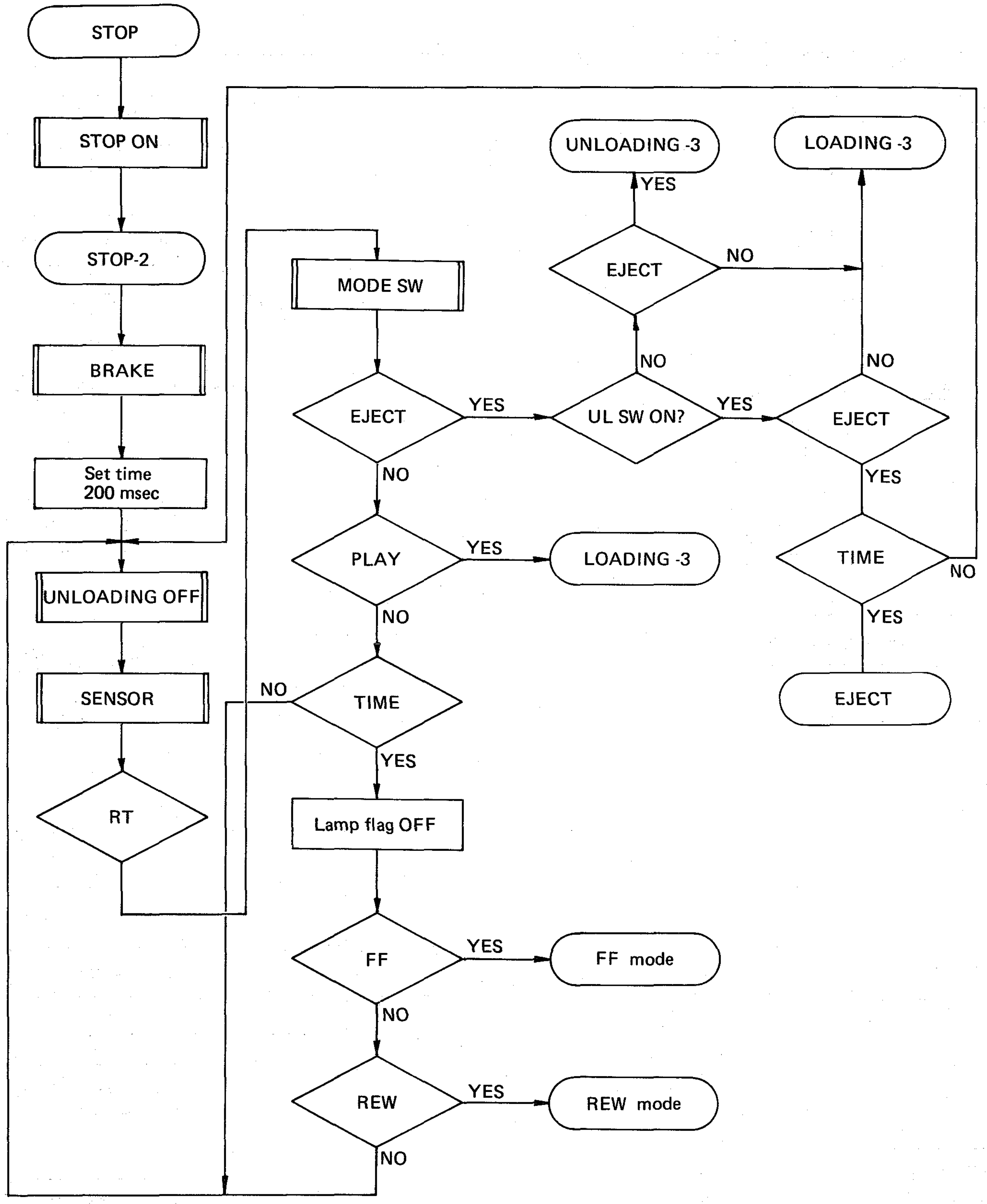
Flag No.	Fanction
Flag 1	Camera input Flag
Flag 2	H: Edit enable L: Edit inhibit
Flag 3	H: Slow Repeat mode
Flag 4	H: Speed Repeat mode
Flag 5	Edit over run Flag
Flag 6	Still Flag by start ensor
Flag 7	Play Flag
Flag 8	Initial play 1 sec Flag
Flag 9	H: Rec OFF input enable
Flag 10	Sub routine for pinch I. III.

3.2.8 FLOWCHARTS

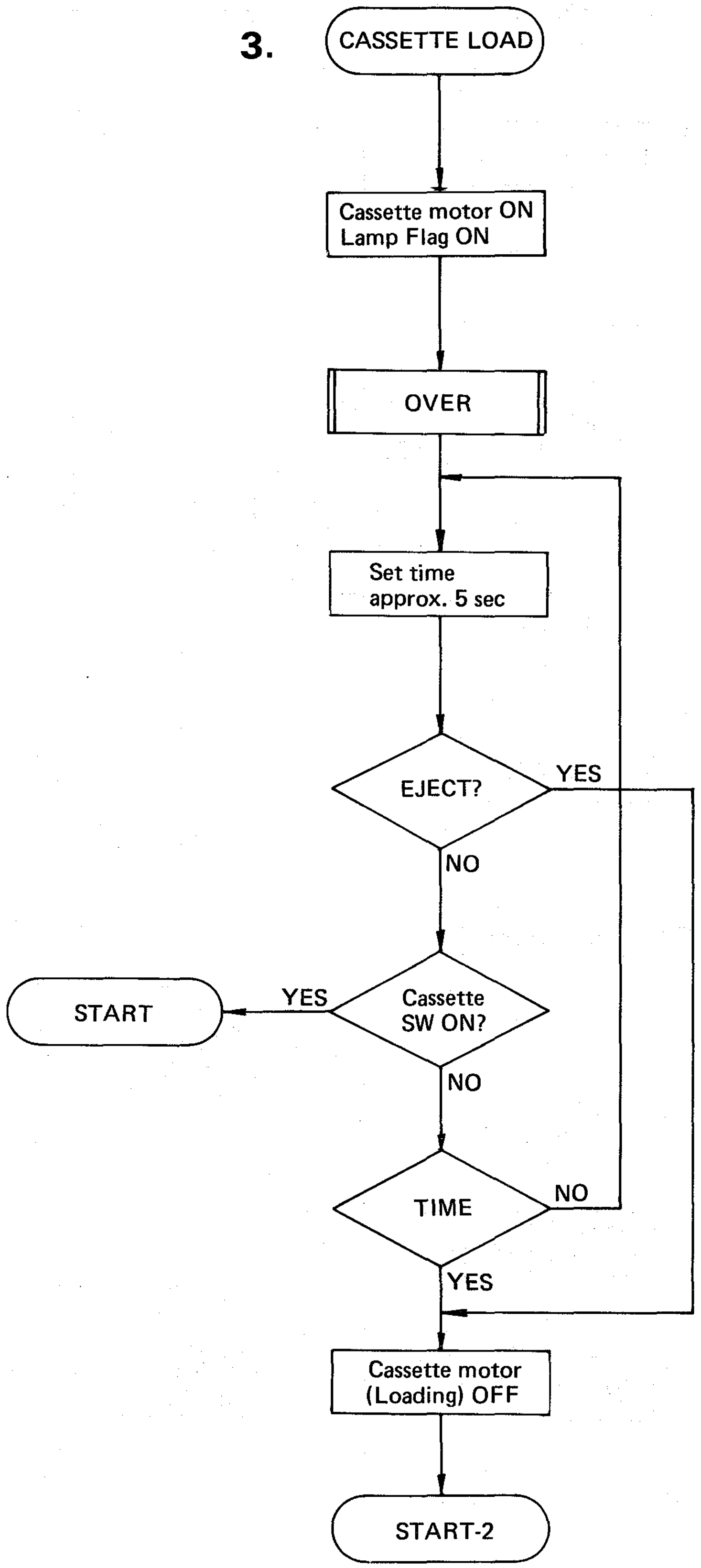
1.


START
All out put clear
E. I.
Cassette SW ON?
YES
NO
START-2
EJECT ON
UL SW ON
NO
UNLOADING
YES
EJECT
Lamp Flag ON cassette motor ⊕ON
Set timer 5.3 sec
Lamp failure
NO
YES
Cassette SW ON
YES
NO
Cassette det. ON
YES
NO
Sub timer set 300 msec
Time
NO
YES
Set timer 5.3 sec
Time
NO
Cassette det. ON
NO
YES
All output clear
YES
Lamp failure
YES
Warning Lamp Flag ON
NO
All output clear
UL SW ON?
NO
START-2
YES
Cassette SW ON
YES
START X
NO
Cassette det. ON
NO
YES
EJECT
Time
NO
YES
UNLOAD OFF
Warning lamp ON
Cassette motor ⊖ ON
Set timer 300 msec
Time
NO
YES
START X
Timer SW ON
NO
STOP-1
YES
REC safety?
NO
YES
REC clear
REC ON
STILL/PAUSE ON
PLAY ON
LOADING

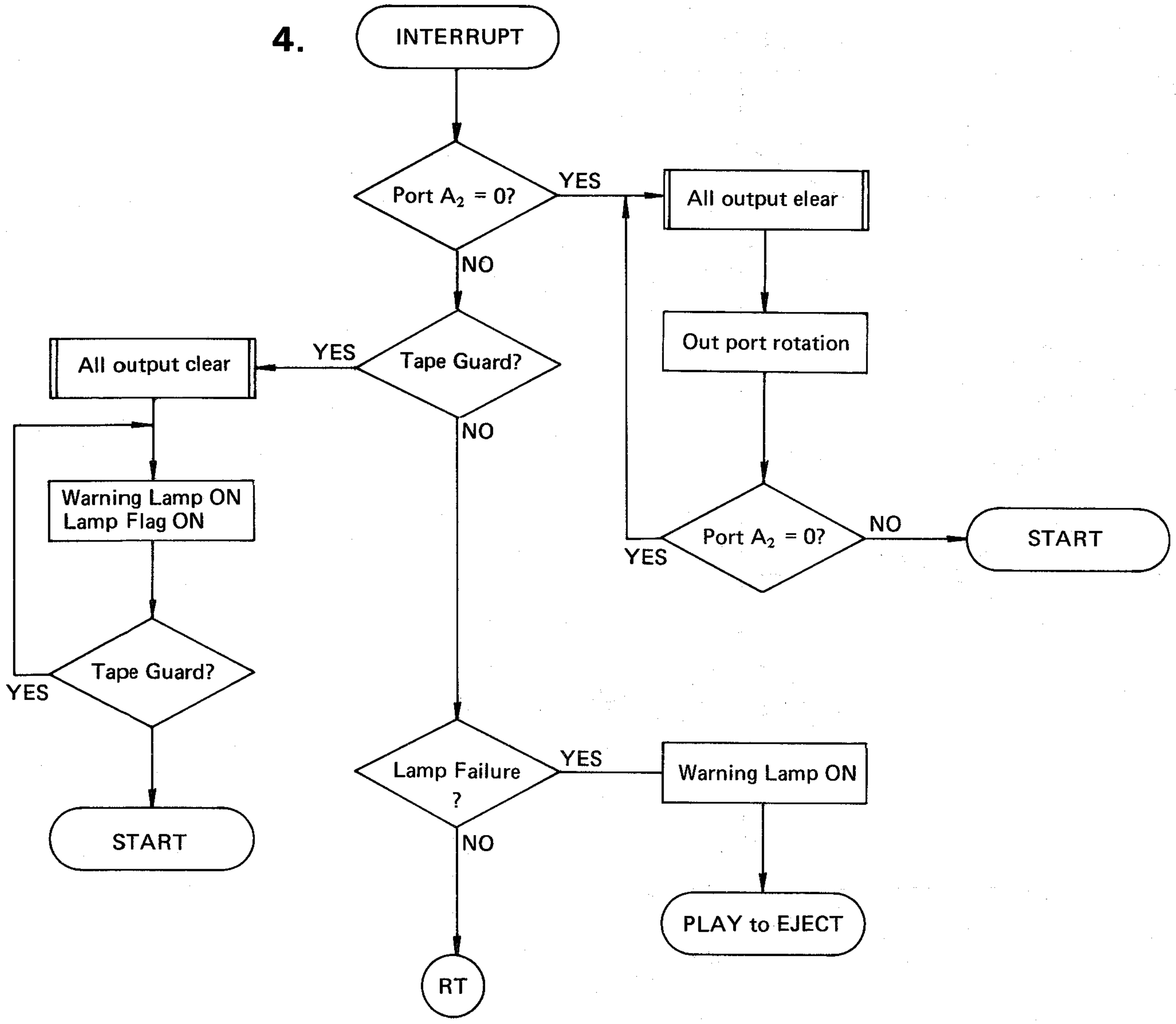
2.


STOP
STOP ON
STOP-2
BRAKE
Set time 200 msec
UNLOADING OFF
SENSOR
RT
MODE SW
EJECT
YES
NO
PLAY
YES
LOADING -3
NO
TIME
NO
YES
Lamp flag OFF
FF
YES
FF mode
NO
REW
YES
REW mode
NO
UL SW ON?
NO
YES
EJECT
YES
UNLOADING -3
NO
EJECT
NO
LOADING -3
YES
TIME
NO
YES
EJECT

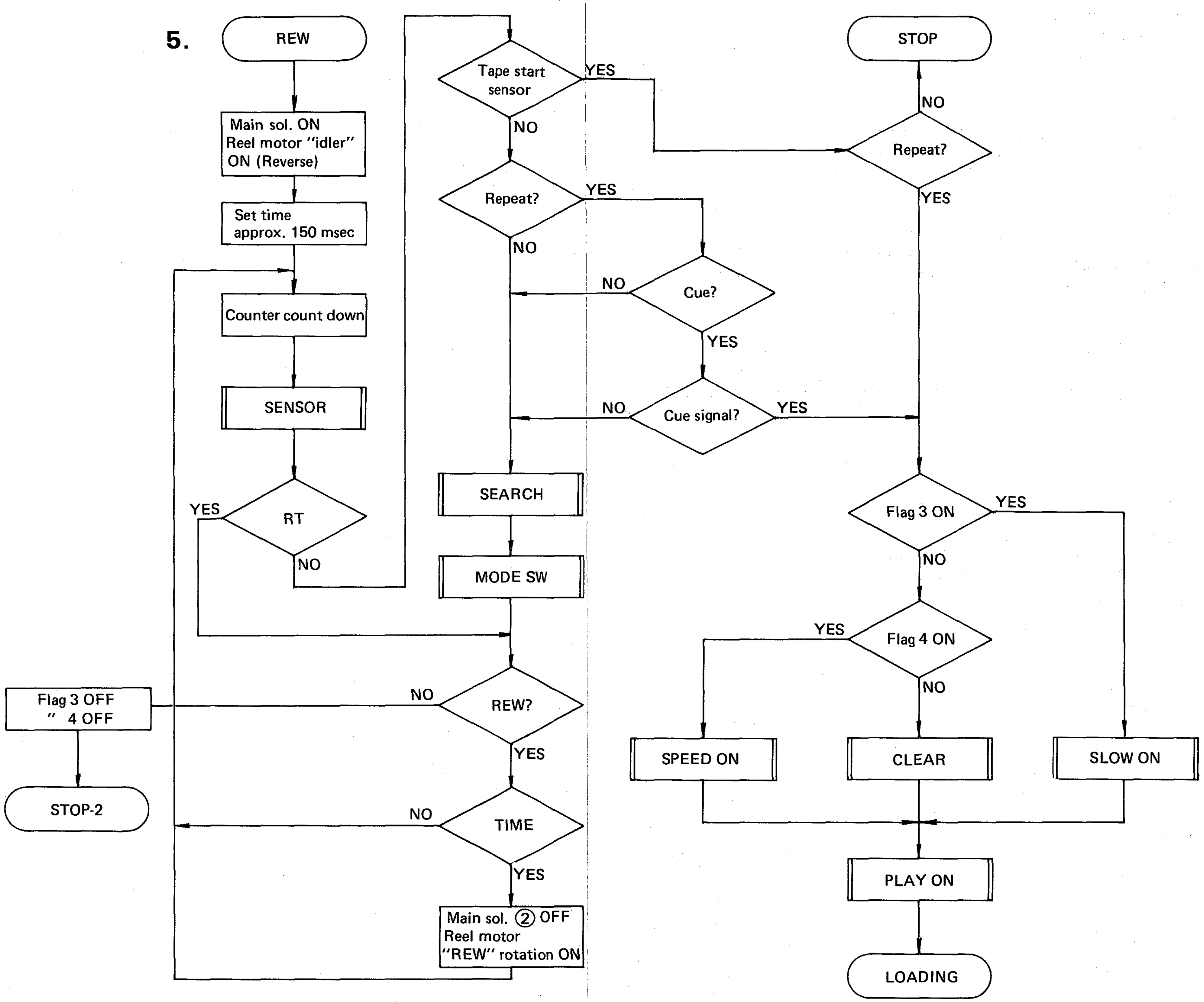
3.


CASSETTE LOAD
Cassette motor ON
Lamp Flag ON
OVER
Set time
approx. 5 sec
EJECT?
YES
NO
Cassette SW ON?
YES
START
NO
TIME
NO
YES
Cassette motor (Loading) OFF
START-2

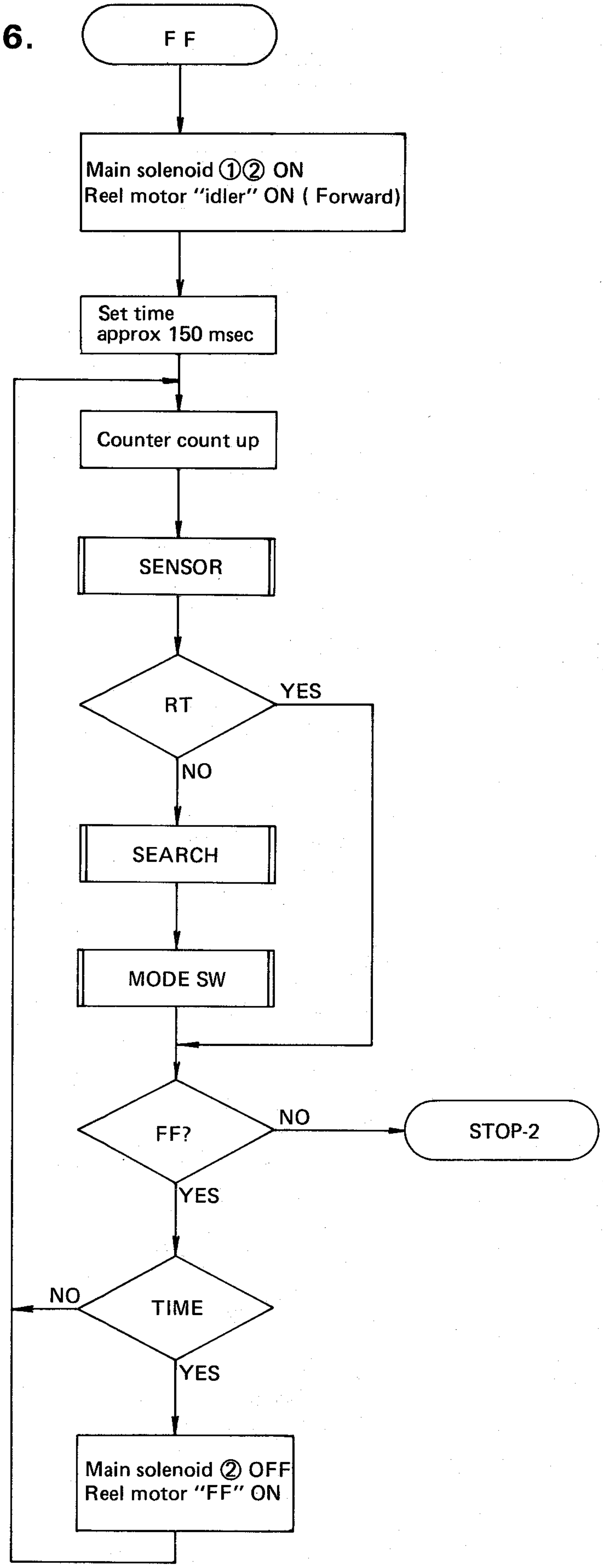
4.


INTERRUPT
Port A_2 = 0?
YES
All output elear
NO
Out port rotation
Tape Guard?
YES
All output clear
NO
Warning Lamp ON
Lamp Flag ON
Port A_2 = 0?
YES
NO
START
Tape Guard?
YES
START
Lamp Failure
?
YES
Warning Lamp ON
NO
PLAY to EJECT
RT

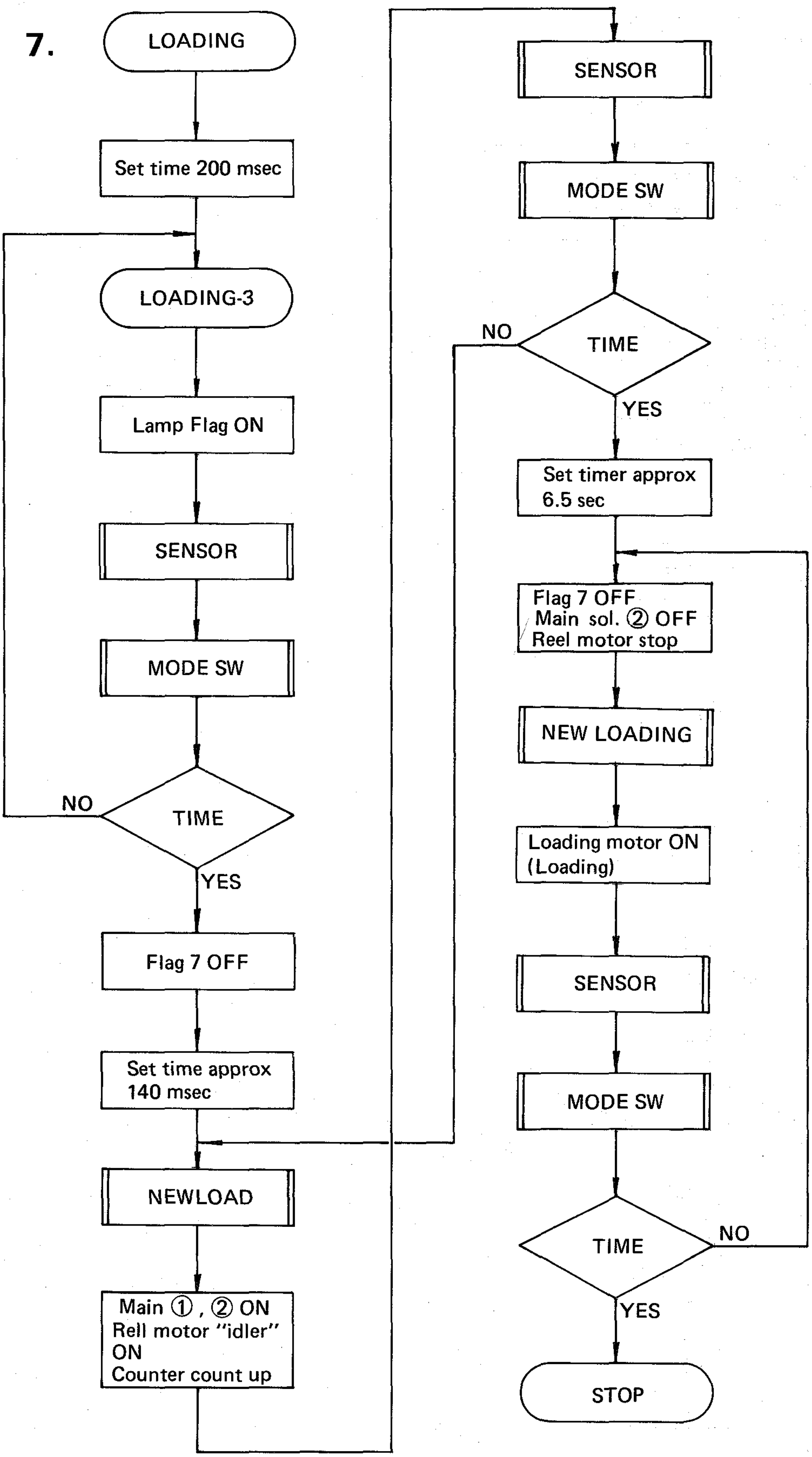
5.

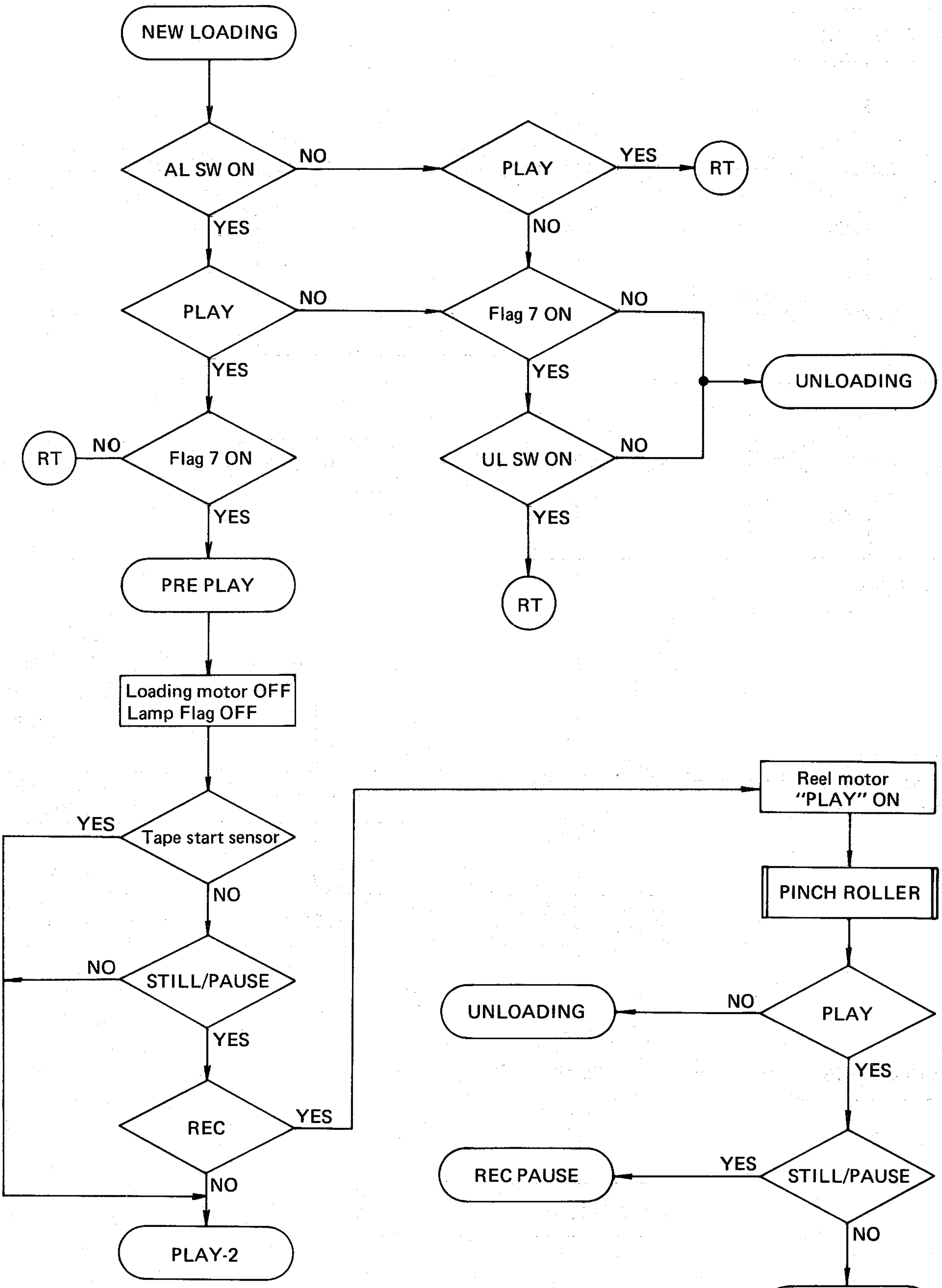

REW
Main sol. ON
Reel motor "idler"
ON (Reverse)
Set time
approx. 150 msec
Counter count down
SENSOR
RT
YES
NO
Tape start
sensor
YES
NO
Repeat?
YES
NO
Cue?
NO
YES
Cue signal?
NO
YES
SEARCH
MODE SW
REW?
NO
YES
Flag 3 OFF
" 4 OFF
STOP-2
TIME
NO
YES
Main sol. ② OFF
Reel motor
"REW" rotation ON
STOP
NO
Repeat?
YES
Flag 3 ON
YES
NO
Flag 4 ON
YES
NO
SPEED ON
CLEAR
SLOW ON
PLAY ON
LOADING

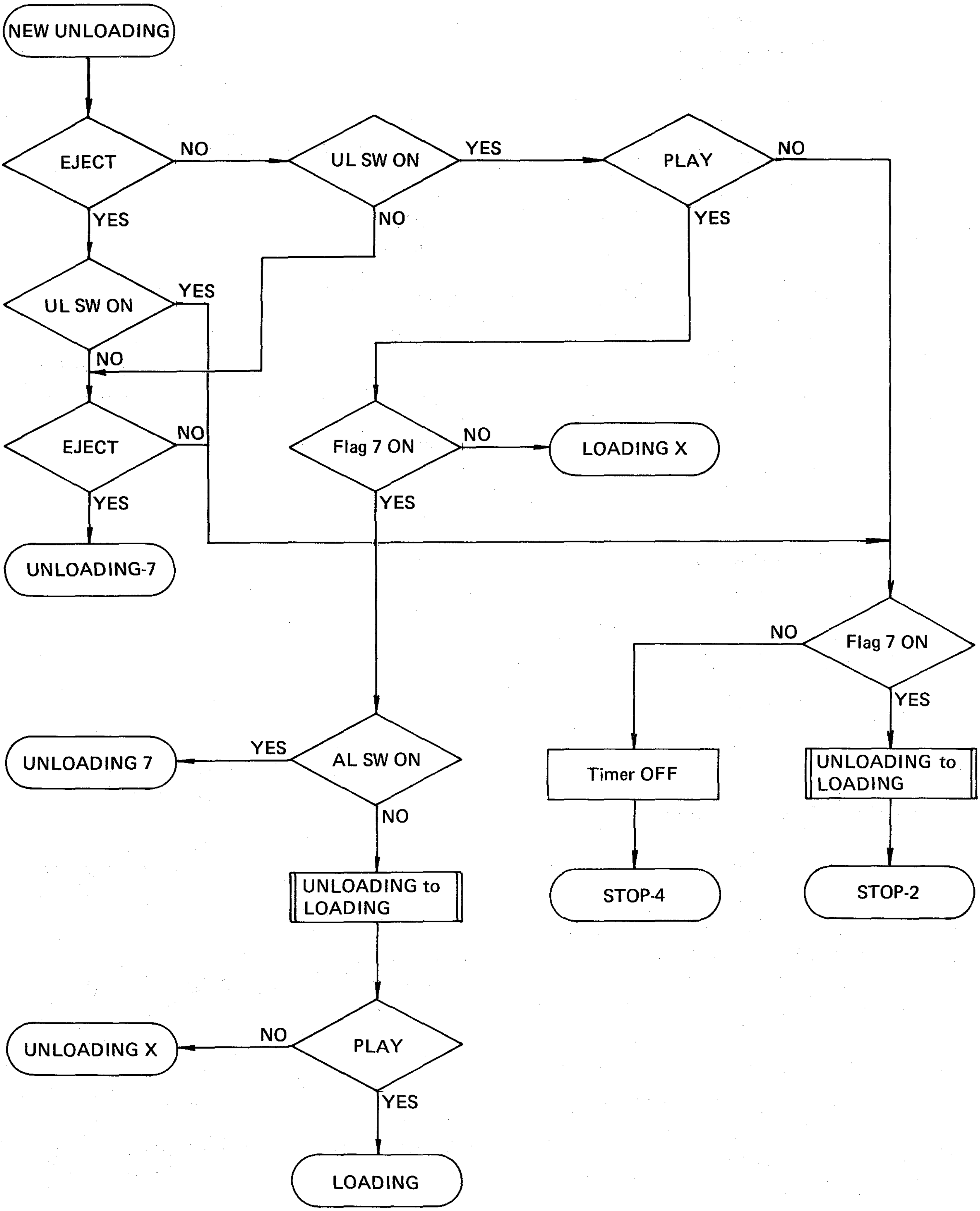
6.


F F
Main solenoid ①② ON
Reel motor "idler" ON (Forward)
Set time
approx 150 msec
Counter count up
SENSOR
RT
YES
NO
SEARCH
MODE SW
FF?
NO
STOP-2
YES
NO
TIME
YES
Main solenoid ② OFF
Reel motor "FF" ON

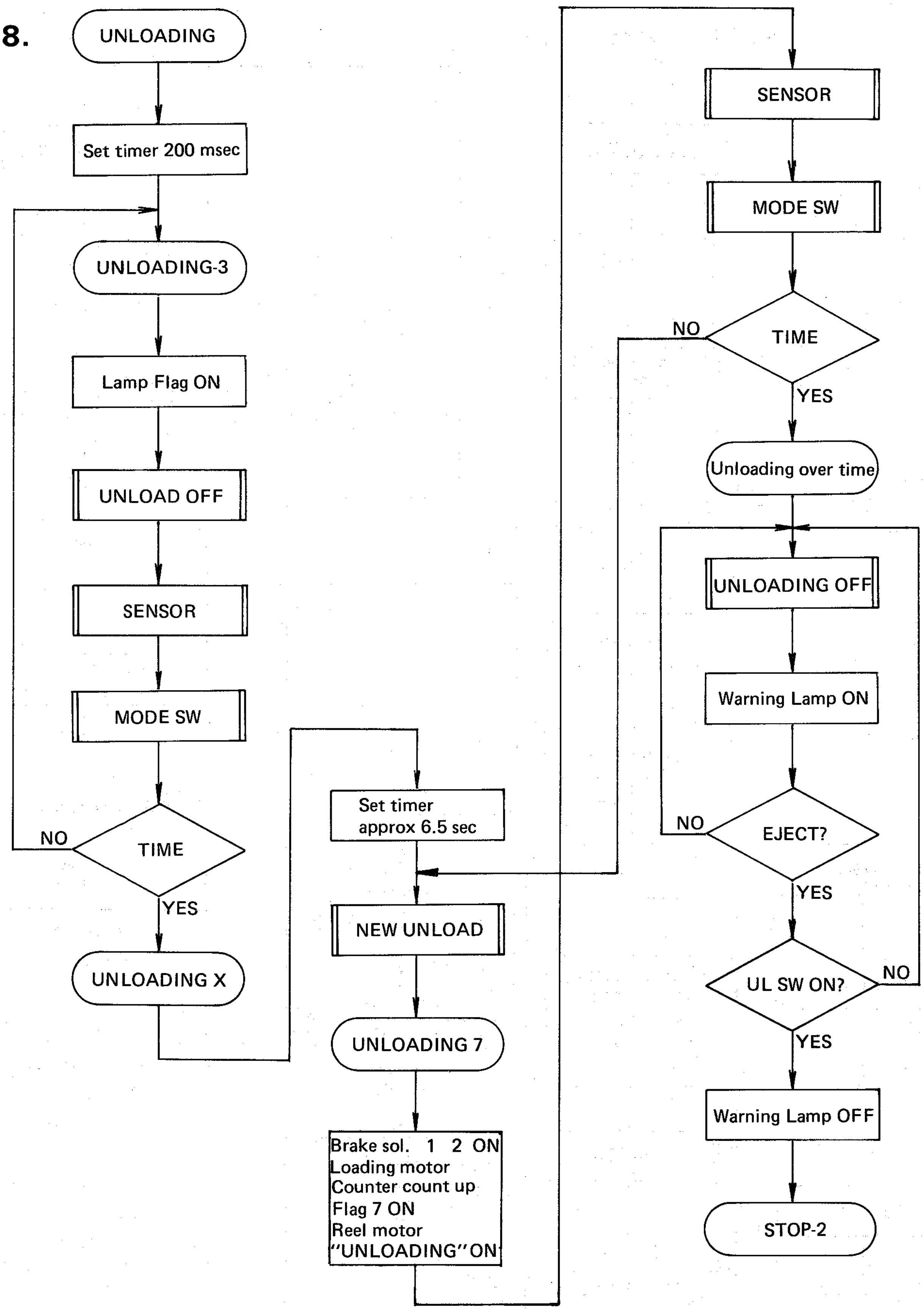
7.


LOADING
Set time 200 msec
LOADING-3
Lamp Flag ON
SENSOR
MODE SW
NO
TIME
YES
Flag 7 OFF
Set time approx 140 msec
NEWLOAD
Main ①, ② ON
Rell motor "idler" ON
Counter count up
SENSOR
MODE SW
NO
TIME
YES
Set timer approx 6.5 sec
Flag 7 OFF
Main sol. ② OFF
Reel motor stop
NEW LOADING
Loading motor ON (Loading)
SENSOR
MODE SW
TIME
NO
YES
STOP

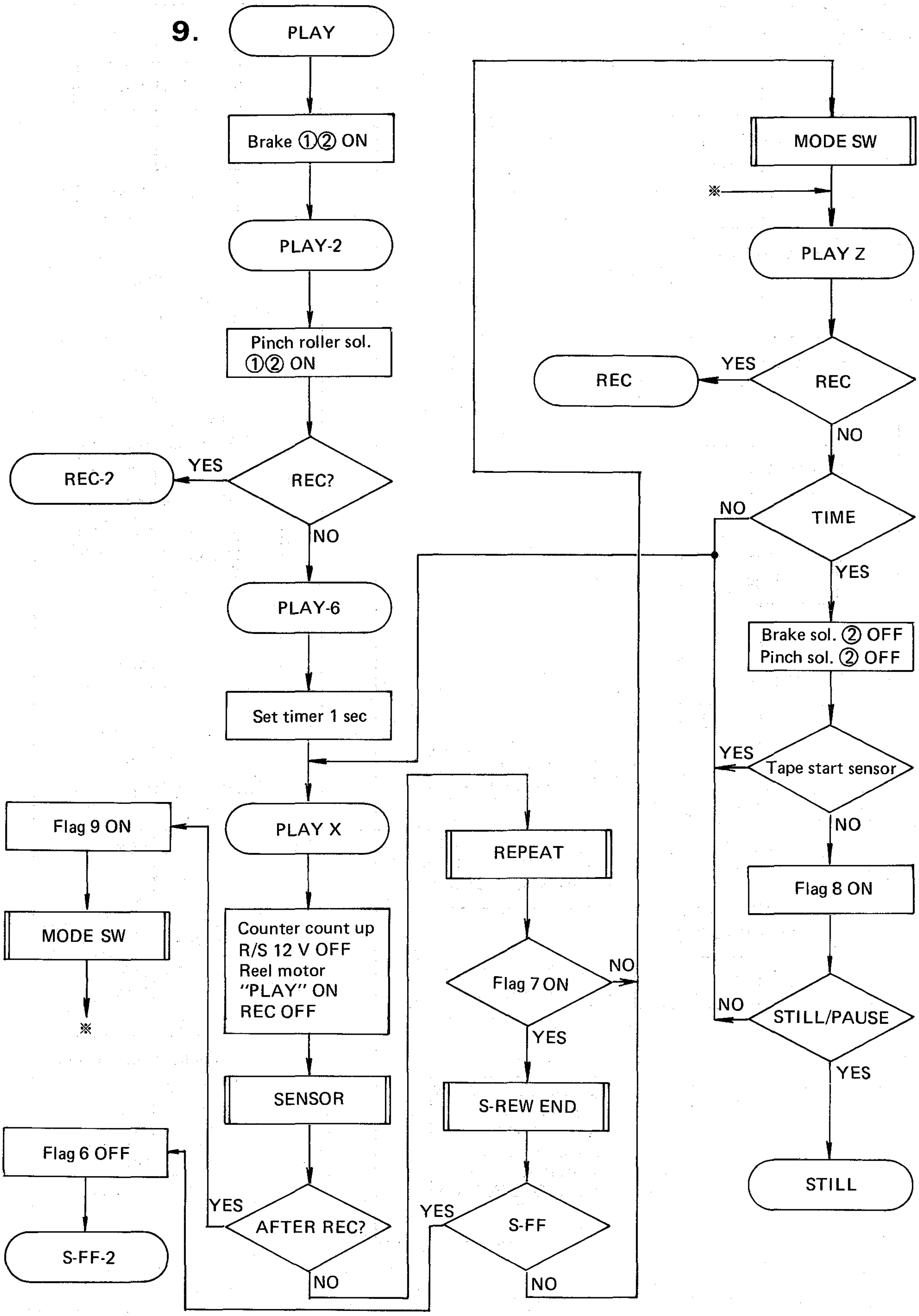

NEW LOADING
AL SW ON
NO
YES
PLAY
YES
RT
NO
PLAY
NO
YES
Flag 7 ON
NO
YES
UNLOADING
RT
NO
Flag 7 ON
UL SW ON
NO
YES
YES
PRE PLAY
RT
Loading motor OFF
Lamp Flag OFF
Reel motor
"PLAY" ON
YES
Tape start sensor
NO
PINCH ROLLER
NO
STILL/PAUSE
UNLOADING
NO
PLAY
YES
YES
YES
REC
REC PAUSE
YES
STILL/PAUSE
NO
NO
PLAY-2
PLAY-2


NEW UNLOADING
EJECT
NO
UL SW ON
YES
PLAY
NO
YES
NO
YES
UL SW ON
YES
NO
EJECT
NO
YES
UNLOADING-7
Flag 7 ON
NO
LOADING X
YES
Flag 7 ON
NO
YES
Timer OFF
UNLOADING to LOADING
STOP-4
STOP-2
UNLOADING 7
YES
AL SW ON
NO
UNLOADING to LOADING
UNLOADING X
NO
PLAY
YES
LOADING

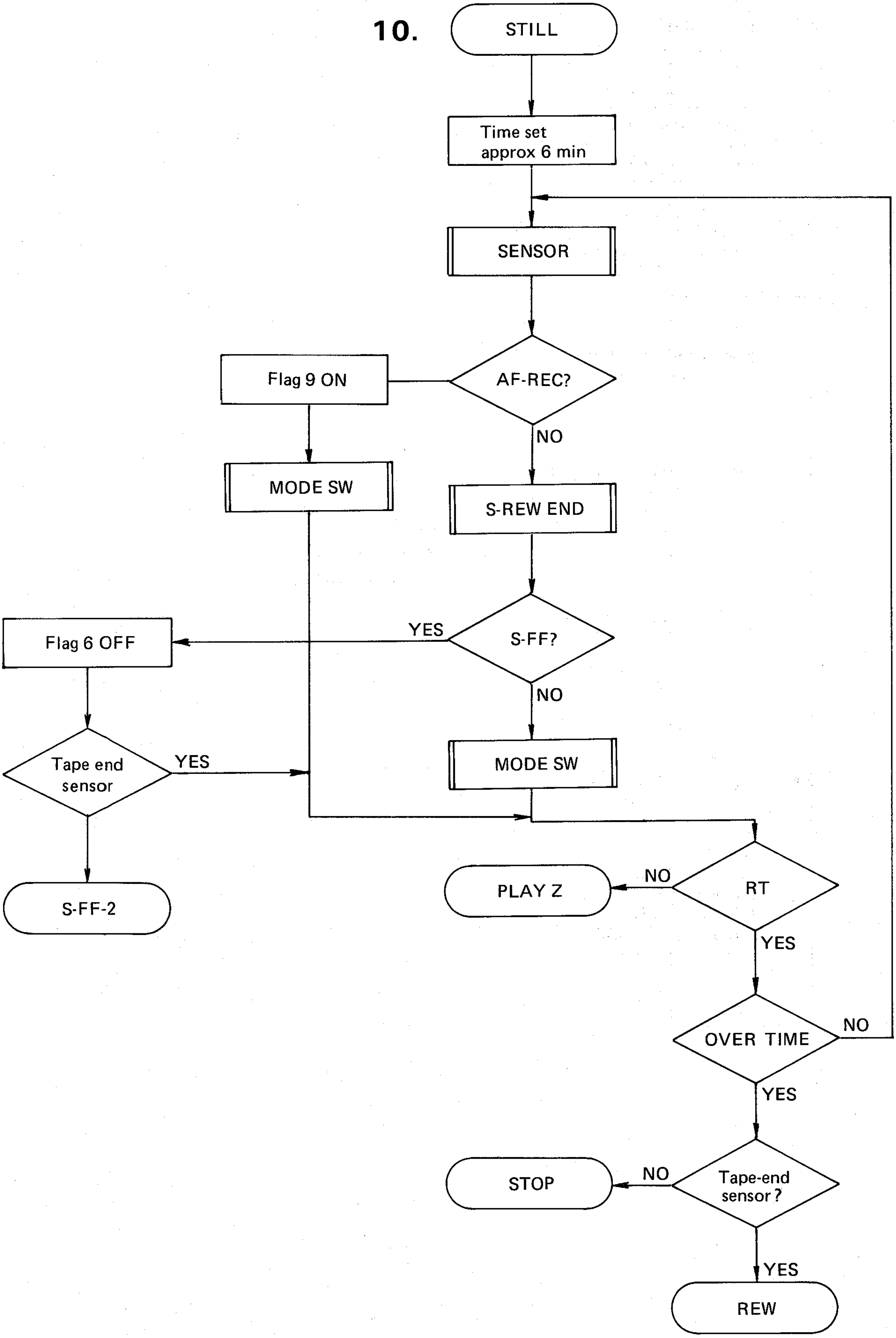
8.


UNLOADING
Set timer 200 msec
UNLOADING-3
Lamp Flag ON
UNLOAD OFF
SENSOR
MODE SW
TIME
NO
YES
UNLOADING X
Set timer approx 6.5 sec
NEW UNLOAD
UNLOADING 7
Brake sol. 1 2 ON
Loading motor
Counter count up
Flag 7 ON
Reel motor
"UNLOADING" ON
SENSOR
MODE SW
TIME
NO
YES
Unloading over time
UNLOADING OFF
Warning Lamp ON
EJECT?
NO
YES
UL SW ON?
NO
YES
Warning Lamp OFF
STOP-2

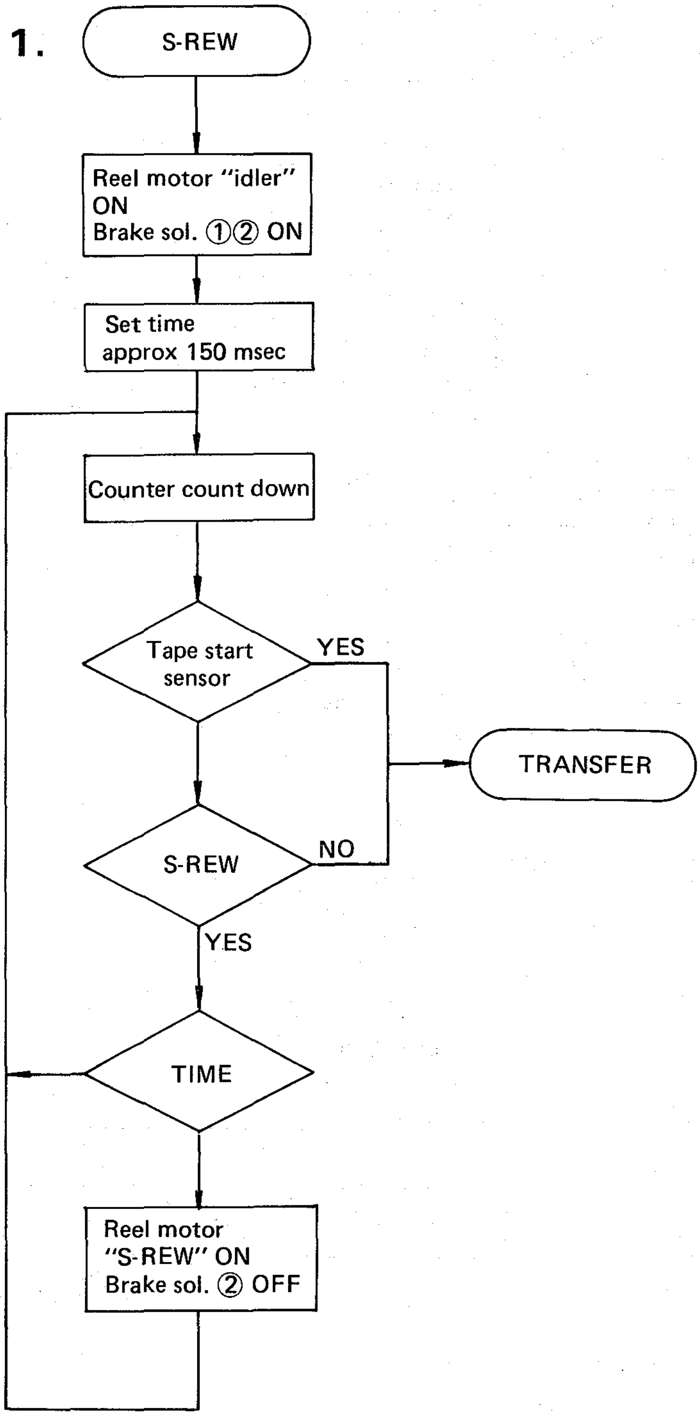
9.

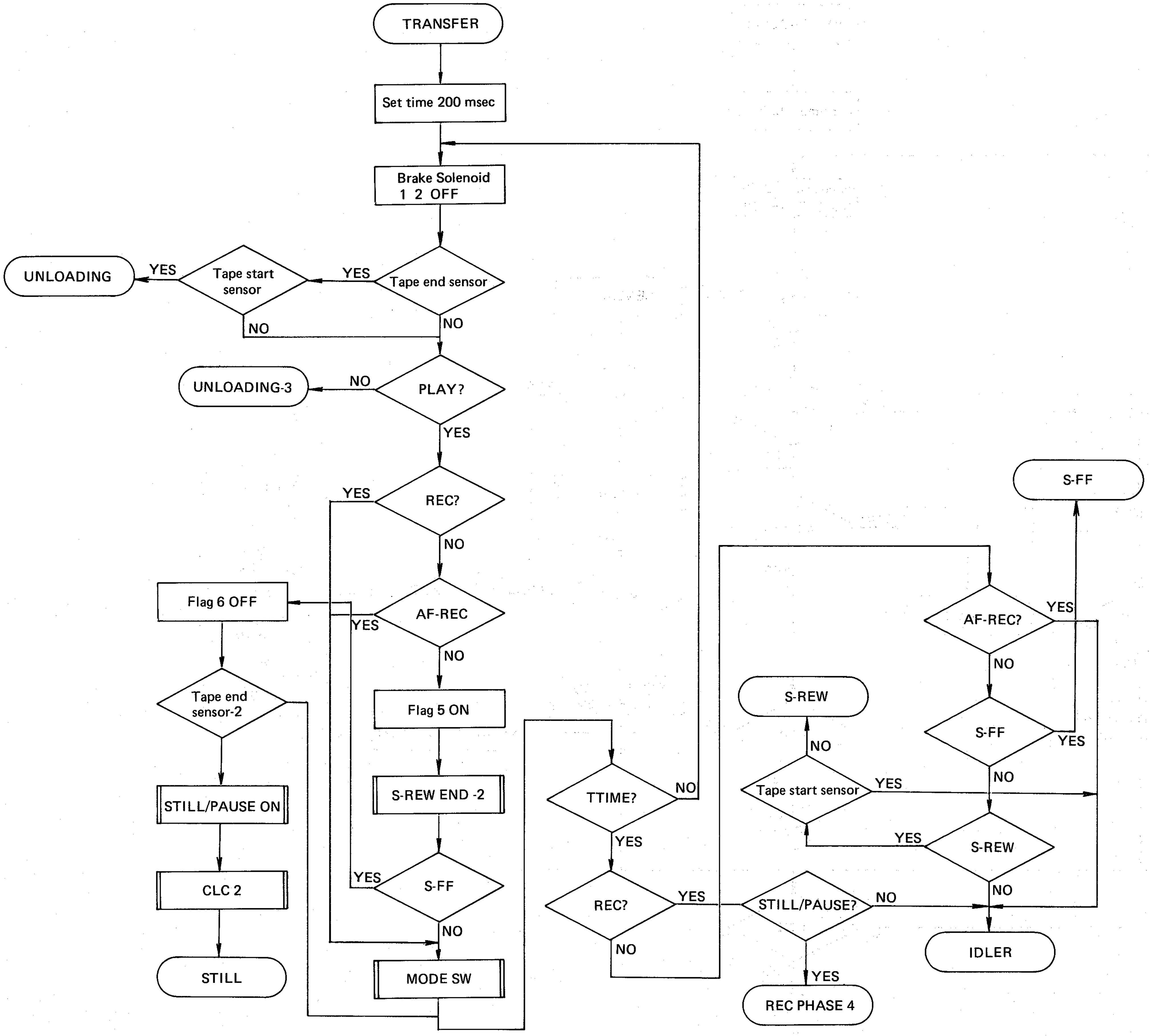

PLAY
Brake ①② ON
PLAY-2
Pinch roller sol. ①② ON
REC?
YES
REC-2
NO
PLAY-6
Set timer 1 sec
PLAY X
Counter count up
R/S 12 V OFF
Reel motor
"PLAY" ON
REC OFF
SENSOR
AFTER REC?
YES
NO
Flag 9 ON
MODE SW
※
Flag 6 OFF
S-FF-2
REPEAT
Flag 7 ON
NO
YES
S-REW END
S-FF
YES
NO
MODE SW
※
PLAY Z
REC
YES
REC
NO
TIME
NO
YES
Brake sol. ② OFF
Pinch sol. ② OFF
Tape start sensor
YES
NO
Flag 8 ON
STILL/PAUSE
NO
YES
STILL

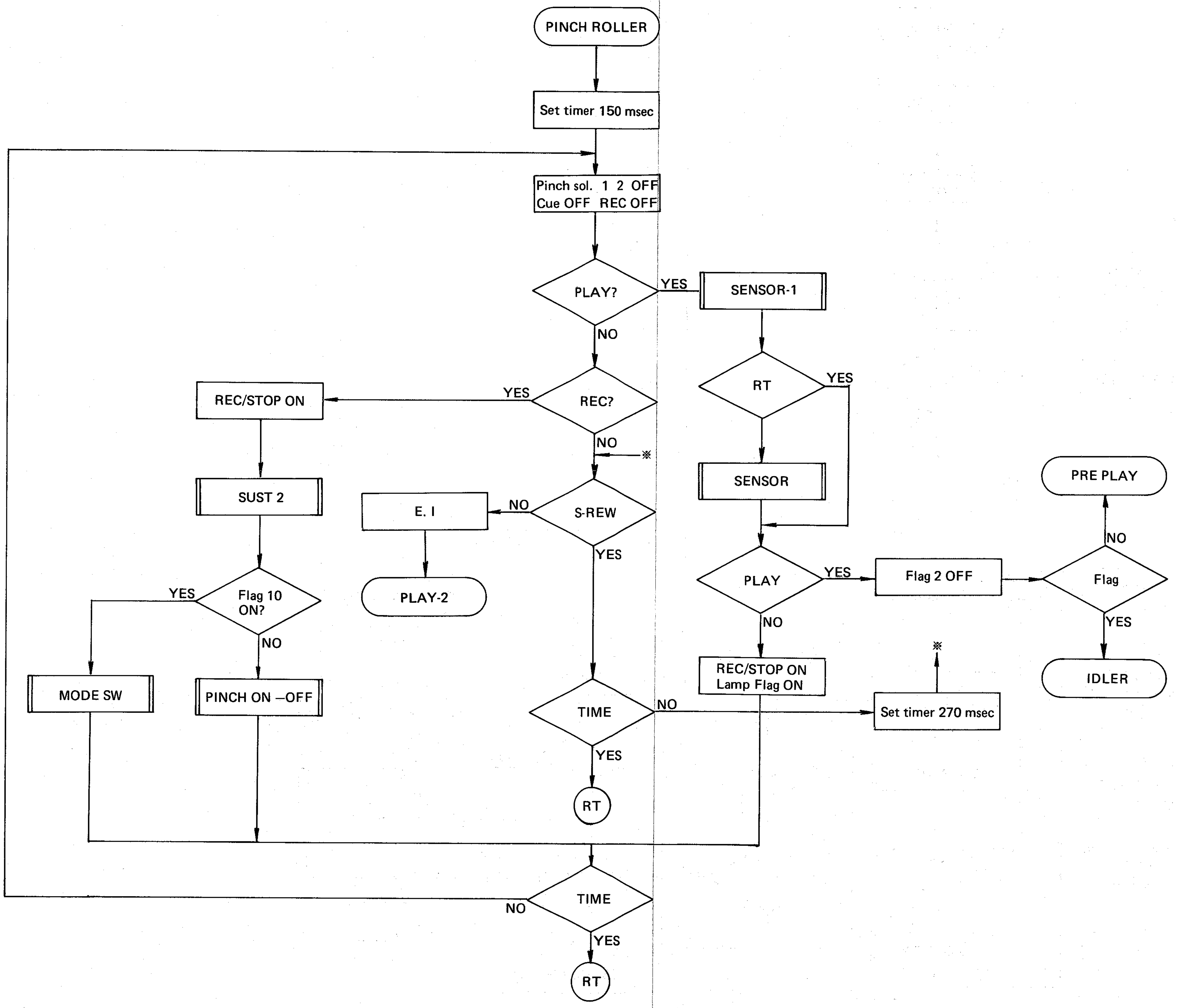
10.

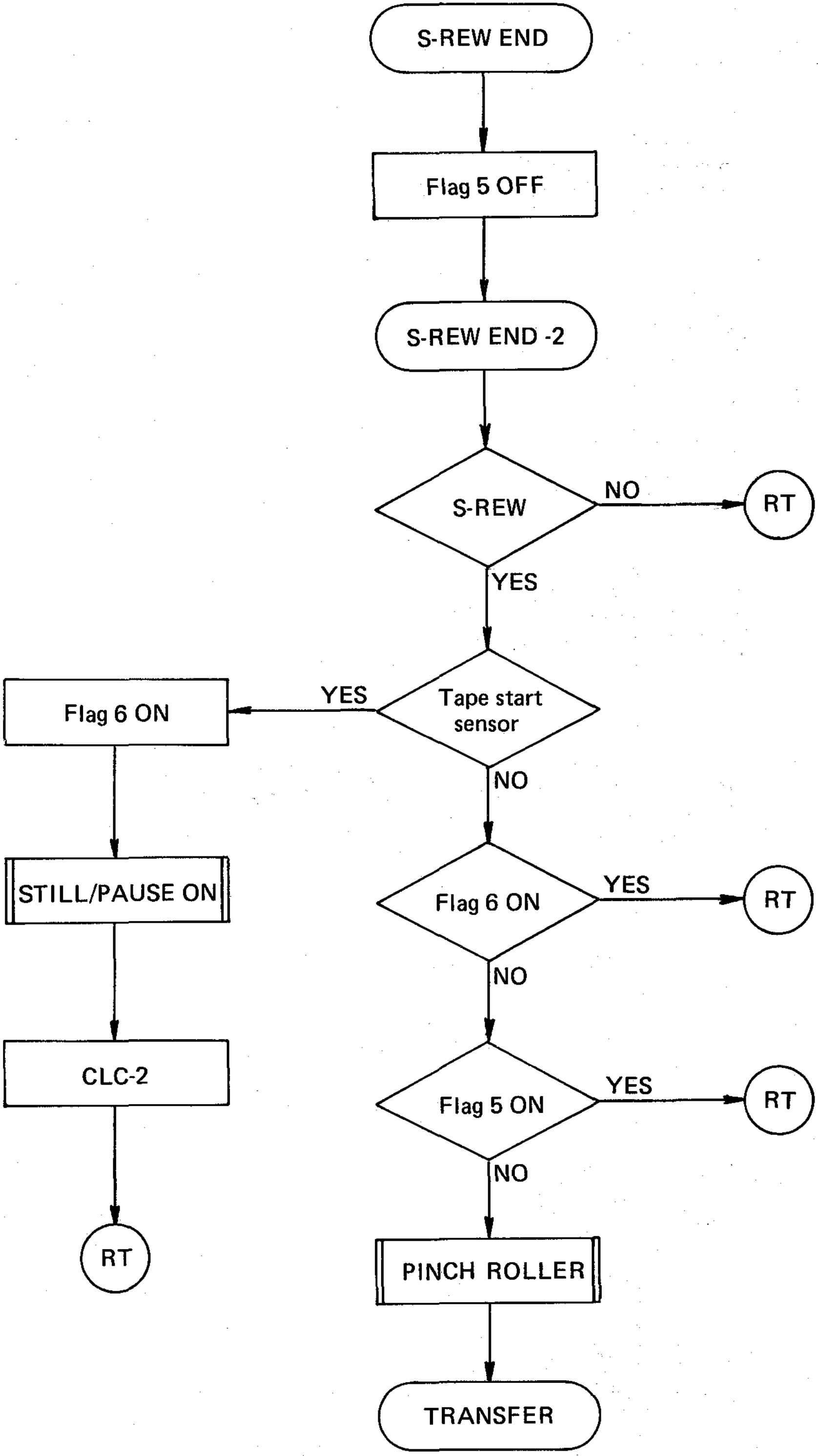

STILL
Time set approx 6 min
SENSOR
AF-REC?
Flag 9 ON
NO
MODE SW
S-REW END
S-FF?
YES
Flag 6 OFF
NO
MODE SW
Tape end sensor
YES
S-FF-2
PLAY Z
NO
RT
YES
OVER TIME
NO
YES
STOP
NO
Tape-end sensor ?
YES
REW

11.

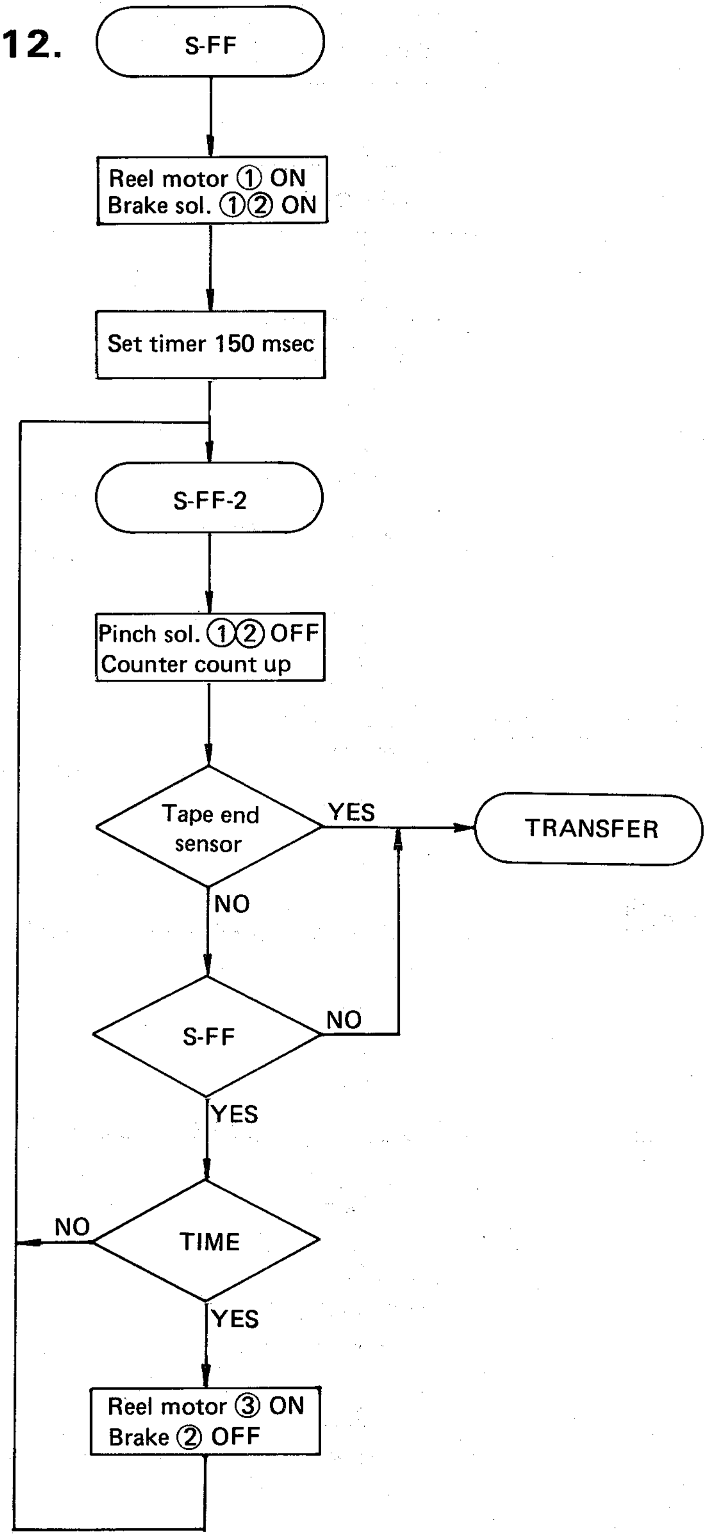

S-REW
Reel motor "idler" ON
Brake sol. ①② ON
Set time approx 150 msec
Counter count down
Tape start sensor
YES
TRANSFER
S-REW
NO
YES
TIME
Reel motor "S-REW" ON
Brake sol. ② OFF


TRANSFER
Set time 200 msec
Brake Solenoid
1 2 OFF
UNLOADING
YES
Tape start sensor
YES
Tape end sensor
NO
NO
UNLOADING-3
NO
PLAY?
YES
YES
REC?
NO
Flag 6 OFF
AF-REC
YES
NO
Tape end sensor-2
Flag 5 ON
S-REW END -2
STILL/PAUSE ON
YES
S-FF
NO
CLC 2
STILL
MODE SW
TTIME?
NO
YES
REC?
YES
NO
S-FF
AF-REC?
YES
NO
S-REW
NO
S-FF
YES
NO
Tape start sensor
YES
YES
S-REW
NO
STILL/PAUSE?
NO
YES
IDLER
REC PHASE 4

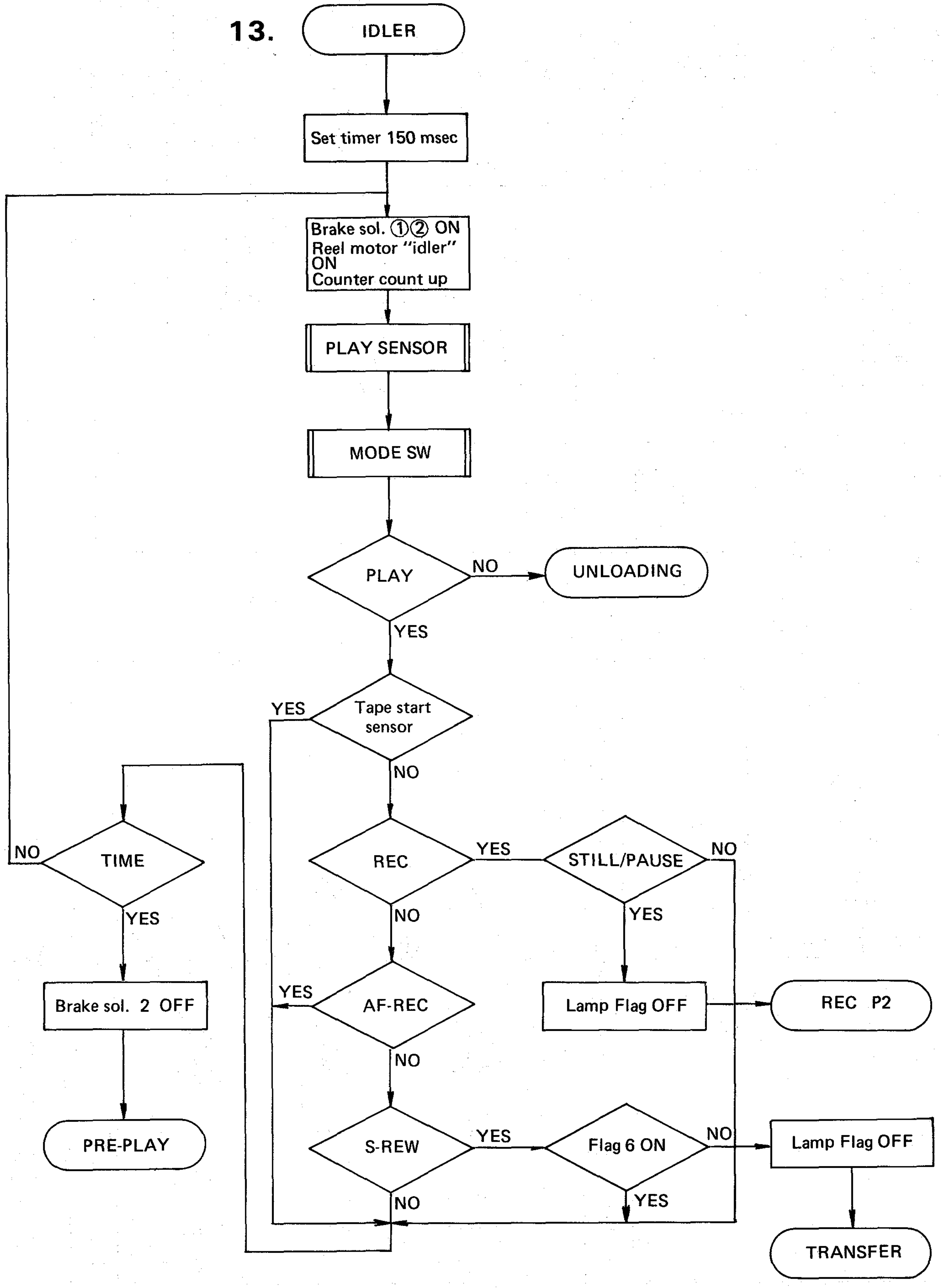

PINCH ROLLER
Set timer 150 msec
Pinch sol. 1 2 OFF
Cue OFF REC OFF
PLAY?
YES
NO
SENSOR-1
RT
YES
SENSOR
REC?
YES
NO
REC/STOP ON
※
S-REW
NO
YES
E. I
PLAY-2
SUST 2
Flag 10 ON?
YES
NO
MODE SW
PINCH ON –OFF
PLAY
YES
NO
Flag 2 OFF
Flag
NO
YES
PRE PLAY
IDLER
REC/STOP ON
Lamp Flag ON
※
Set timer 270 msec
TIME
NO
YES
RT
TIME
NO
YES
RT


S-REW END
Flag 5 OFF
S-REW END -2
S-REW
NO
RT
YES
Tape start sensor
YES
Flag 6 ON
NO
STILL/PAUSE ON
Flag 6 ON
YES
RT
NO
CLC-2
Flag 5 ON
YES
RT
NO
RT
PINCH ROLLER
TRANSFER

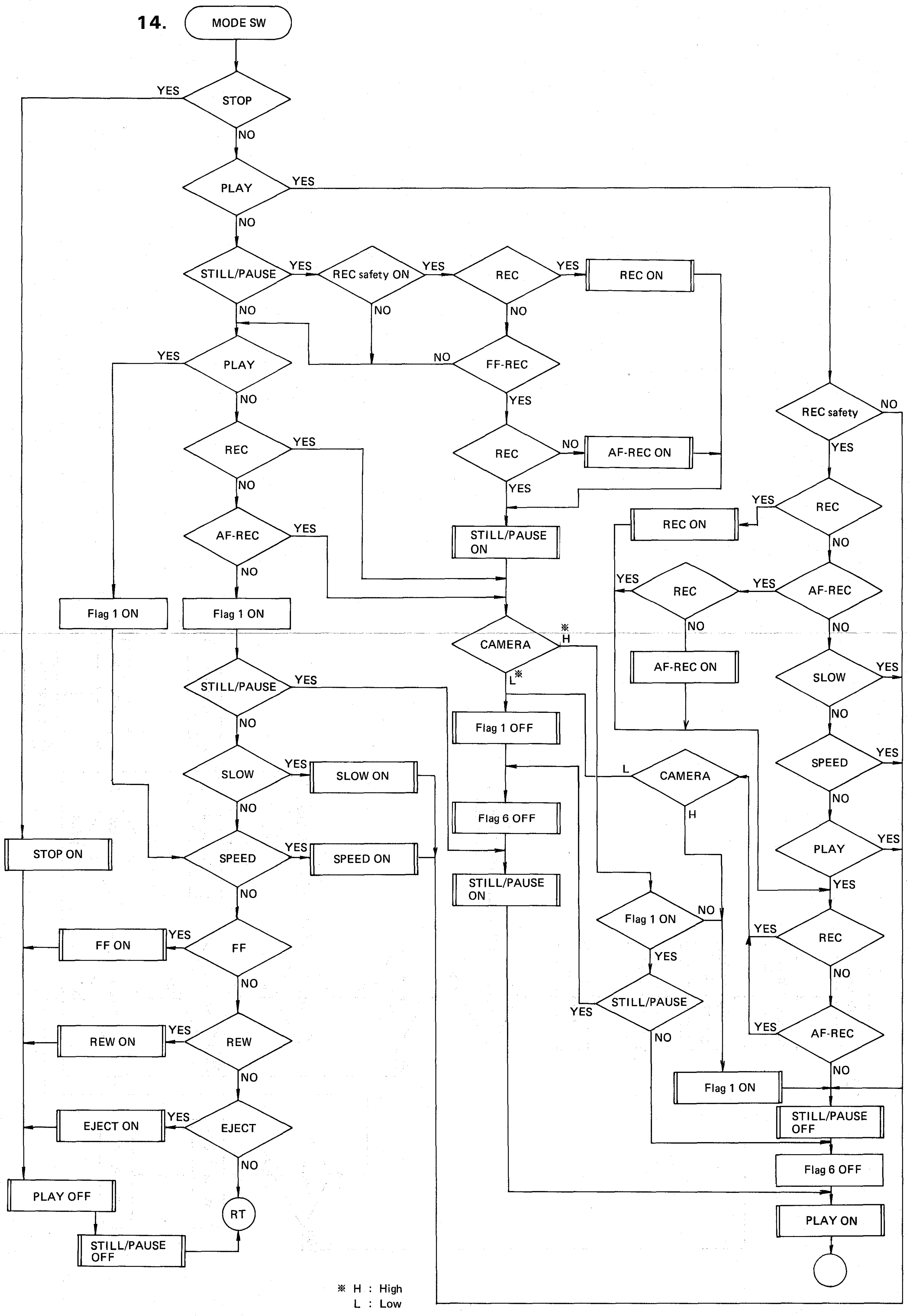
12.


S-FF
Reel motor ① ON
Brake sol. ①② ON
Set timer 150 msec
S-FF-2
Pinch sol. ①② OFF
Counter count up
Tape end sensor
YES
TRANSFER
NO
S-FF
NO
YES
NO
TIME
YES
Reel motor ③ ON
Brake ② OFF

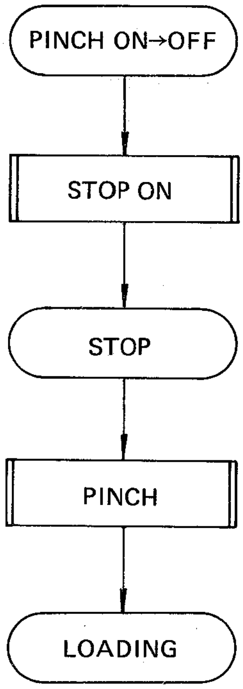
13.


IDLER
Set timer 150 msec
Brake sol. ①② ON
Reel motor "idler" ON
Counter count up
PLAY SENSOR
MODE SW
PLAY
NO
UNLOADING
YES
Tape start sensor
YES
NO
TIME
NO
YES
Brake sol. 2 OFF
PRE-PLAY
REC
YES
STILL/PAUSE
NO
YES
Lamp Flag OFF
REC P2
NO
AF-REC
YES
NO
S-REW
YES
Flag 6 ON
NO
Lamp Flag OFF
TRANSFER
YES
NO

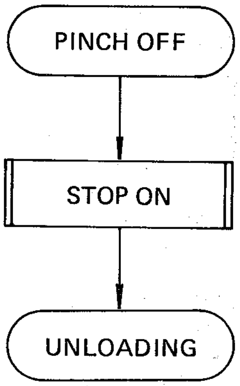
14.


MODE SW
STOP
PLAY
STILL/PAUSE
REC safety ON
REC
REC ON
FF-REC
PLAY
REC
AF-REC ON
AF-REC
STILL/PAUSE ON
Flag 1 ON
Flag 1 ON
CAMERA
STILL/PAUSE
SLOW
SLOW ON
SPEED
SPEED ON
STOP ON
FF
FF ON
REW
REW ON
EJECT
EJECT ON
PLAY OFF
STILL/PAUSE OFF
RT
Flag 1 OFF
Flag 6 OFF
STILL/PAUSE ON
REC safety
REC
REC ON
AF-REC
REC
AF-REC ON
SLOW
SPEED
PLAY
CAMERA
Flag 1 ON
STILL/PAUSE
REC
AF-REC
Flag 1 ON
STILL/PAUSE OFF
Flag 6 OFF
PLAY ON
YES
NO
※H
L※
H
L
※ H : High
L : Low

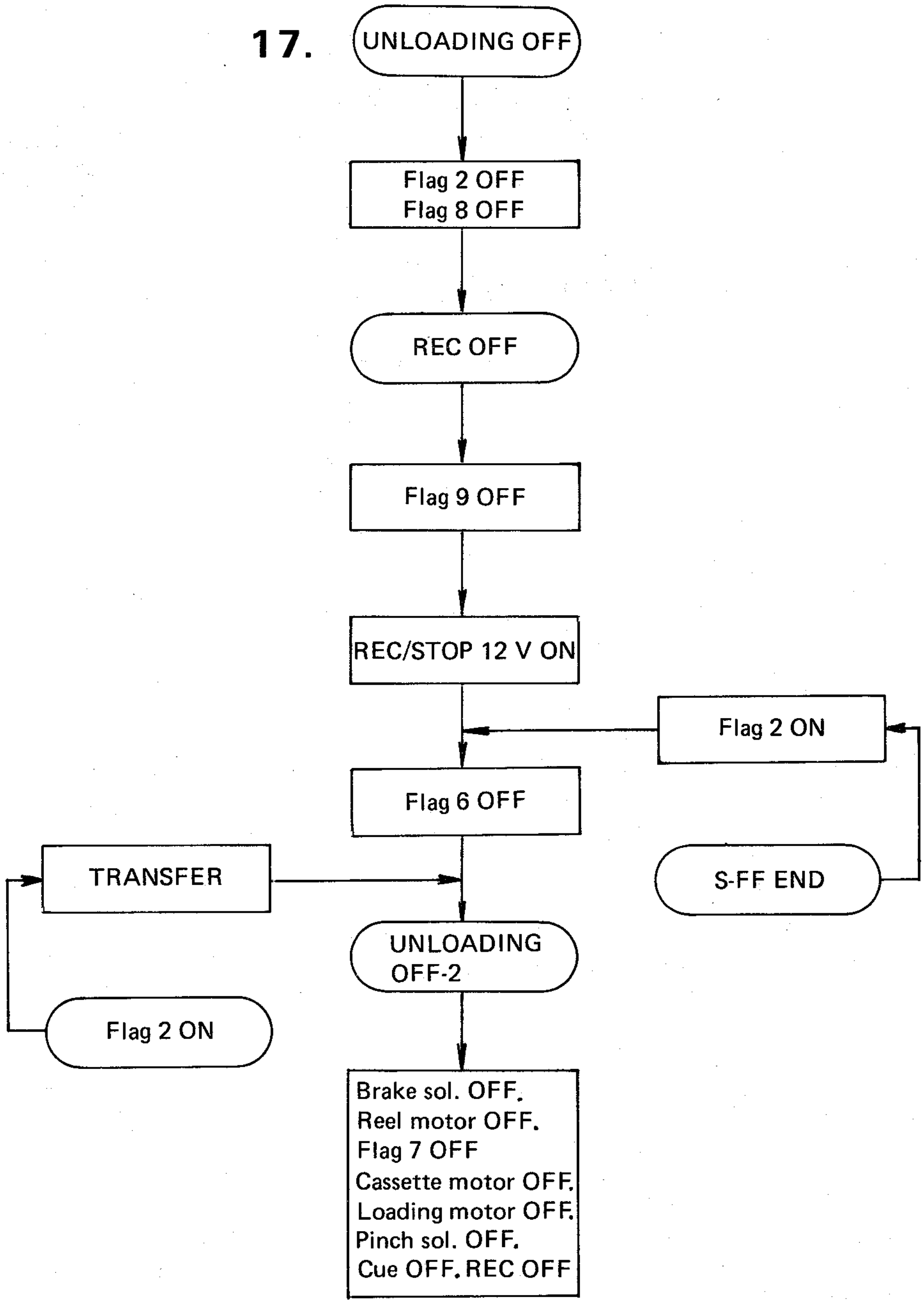
15.


PINCH ON→OFF
STOP ON
STOP
PINCH
LOADING

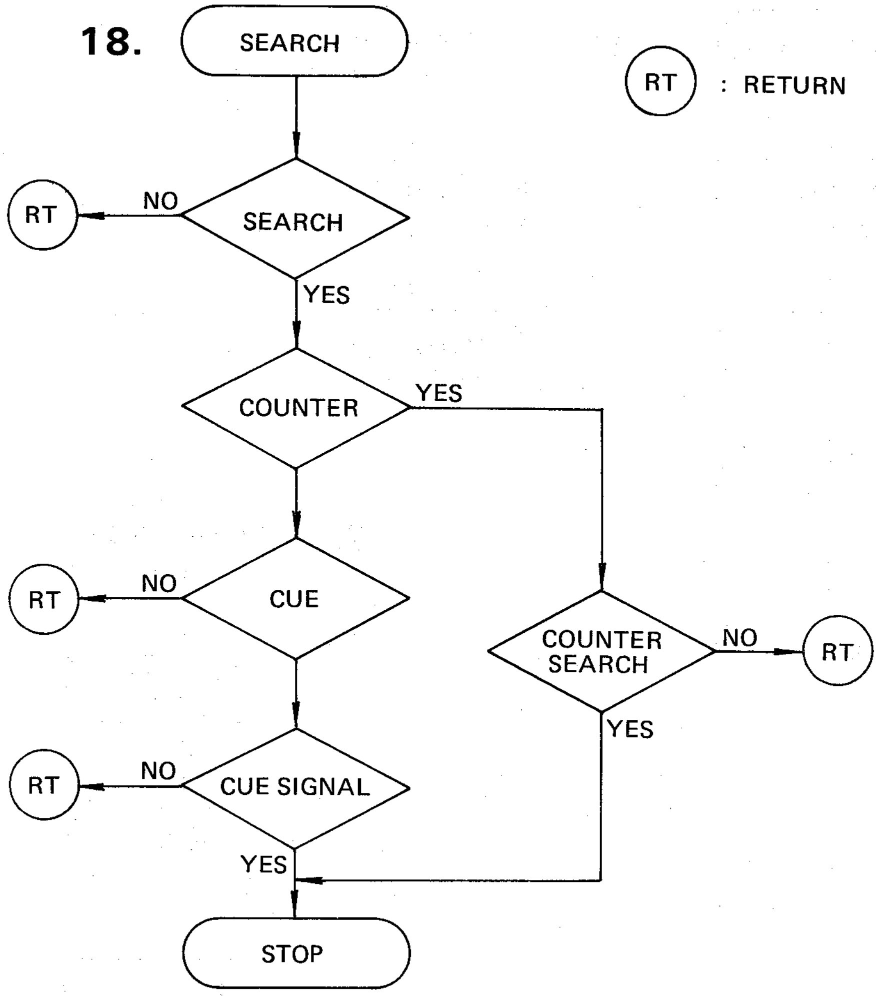
16.


PINCH OFF
STOP ON
UNLOADING

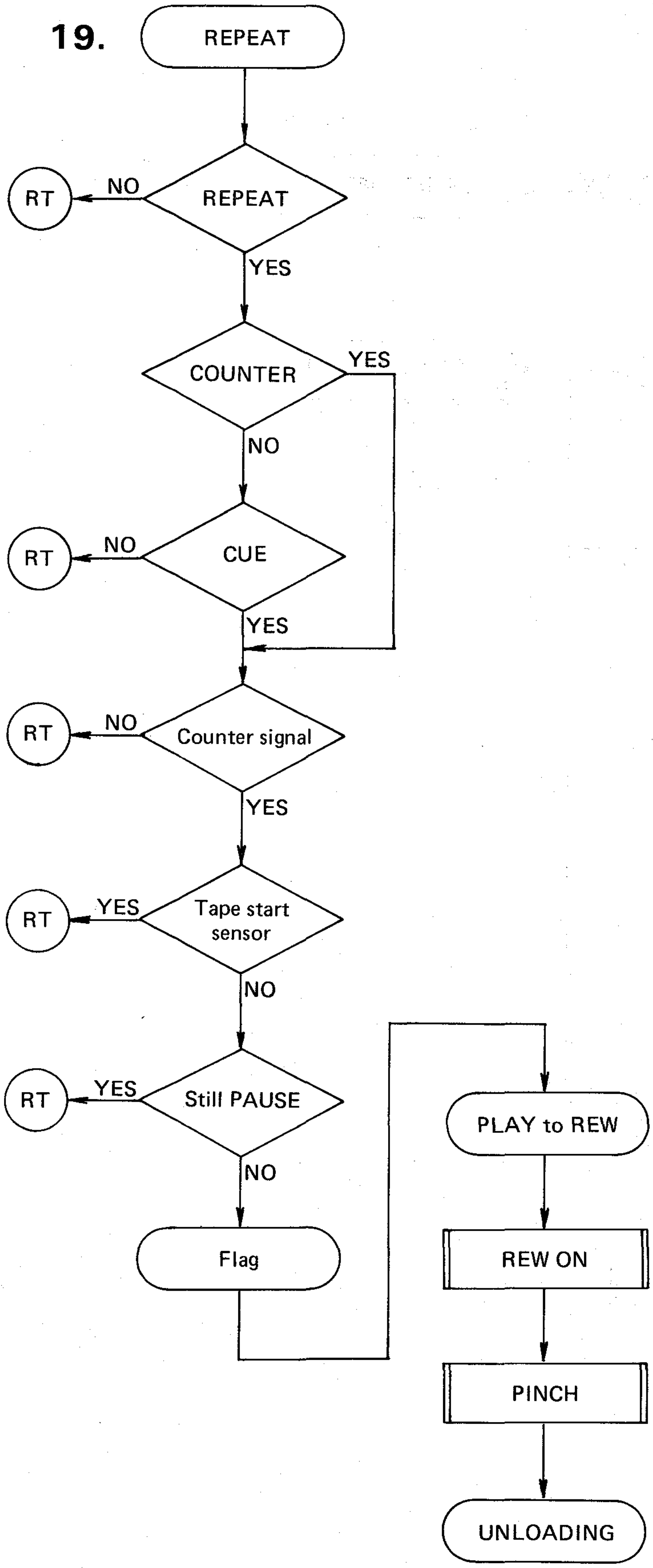
17.


UNLOADING OFF
Flag 2 OFF
Flag 8 OFF
REC OFF
Flag 9 OFF
REC/STOP 12 V ON
Flag 2 ON
S-FF END
Flag 6 OFF
TRANSFER
Flag 2 ON
UNLOADING OFF-2
Brake sol. OFF.
Reel motor OFF.
Flag 7 OFF
Cassette motor OFF.
Loading motor OFF.
Pinch sol. OFF.
Cue OFF. REC OFF

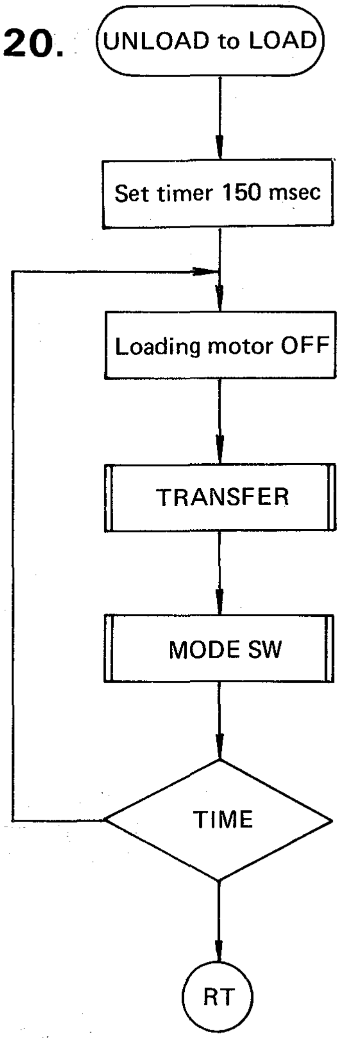
18.


SEARCH
RT
: RETURN
RT
NO
SEARCH
YES
COUNTER
YES
RT
NO
CUE
COUNTER SEARCH
NO
RT
YES
RT
NO
CUE SIGNAL
YES
STOP

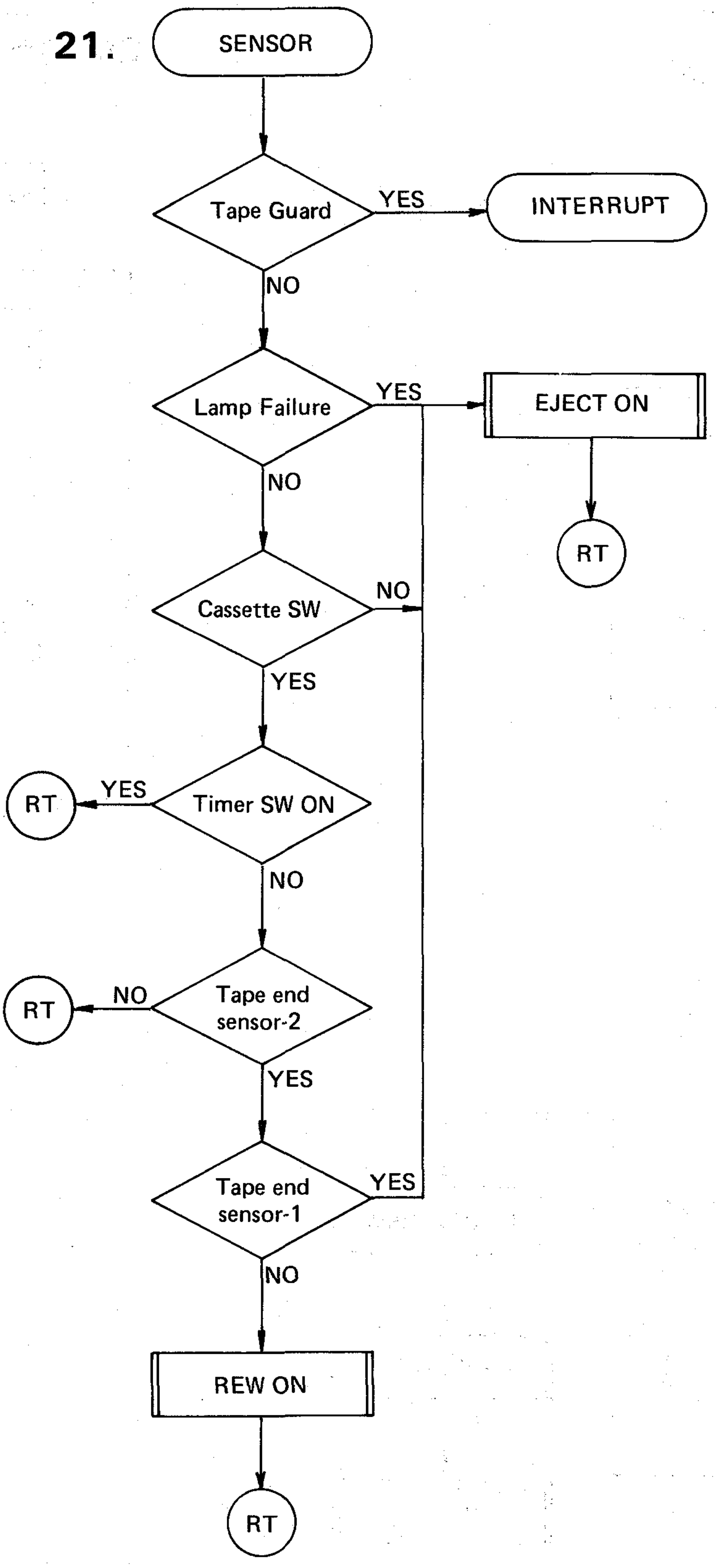
19.


REPEAT
RT
NO
REPEAT
YES
COUNTER
YES
NO
RT
NO
CUE
YES
RT
NO
Counter signal
YES
RT
YES
Tape start sensor
NO
RT
YES
Still PAUSE
NO
Flag
PLAY to REW
REW ON
PINCH
UNLOADING

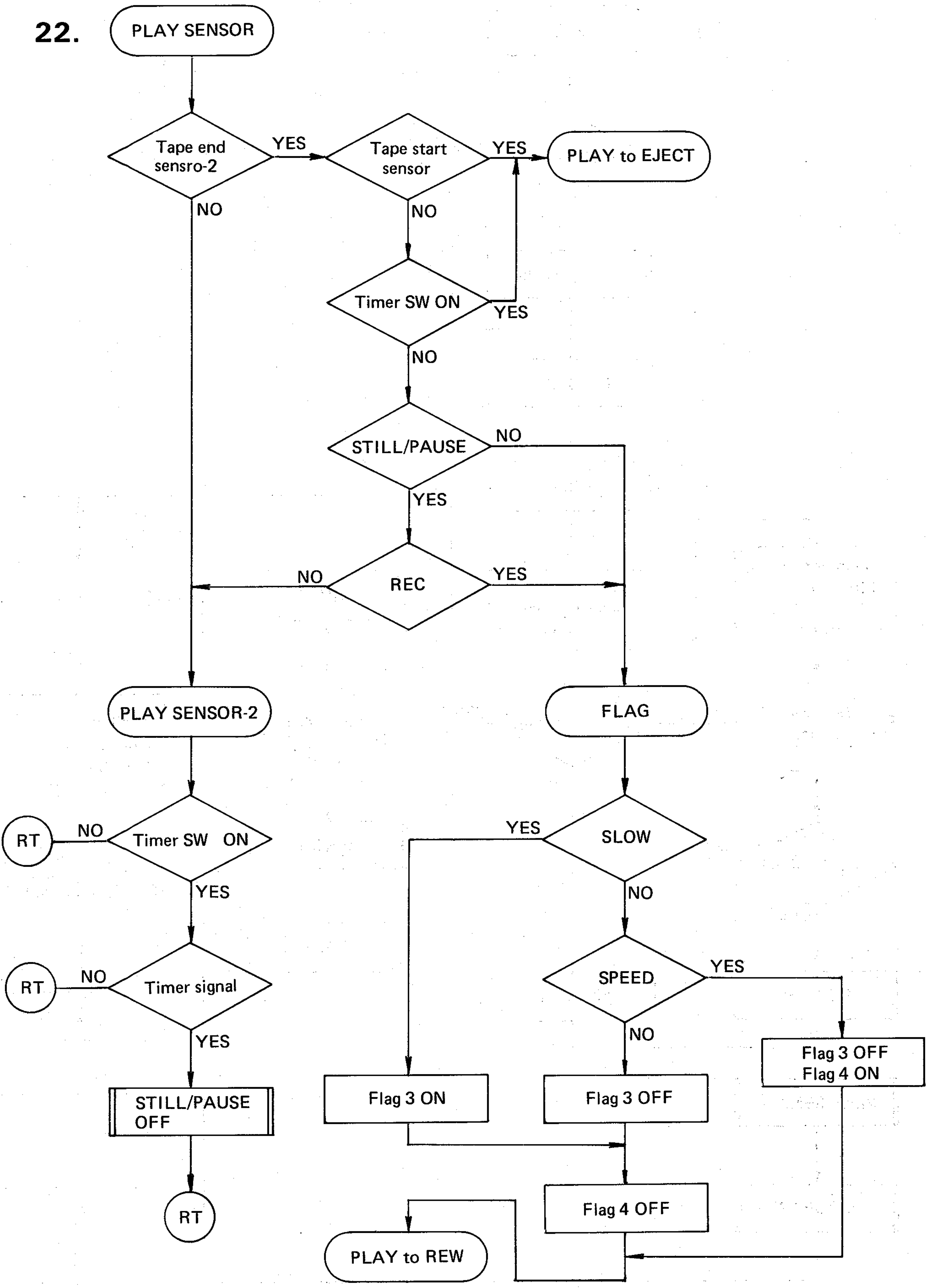
20.


UNLOAD to LOAD
Set timer 150 msec
Loading motor OFF
TRANSFER
MODE SW
TIME
RT

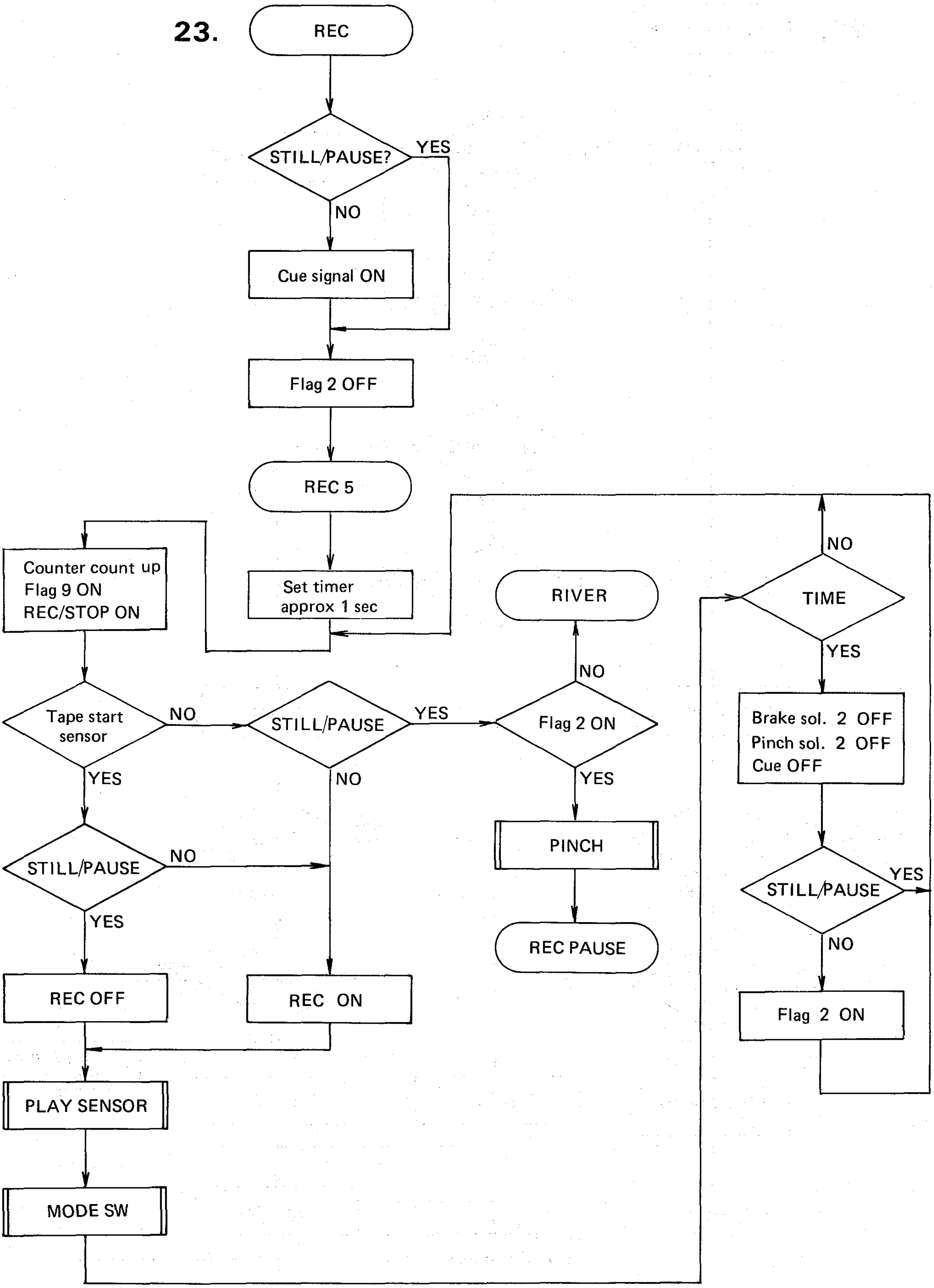
21.


SENSOR
Tape Guard
YES
INTERRUPT
NO
Lamp Failure
YES
EJECT ON
RT
NO
Cassette SW
NO
YES
RT
YES
Timer SW ON
NO
RT
NO
Tape end sensor-2
YES
Tape end sensor-1
YES
NO
REW ON
RT

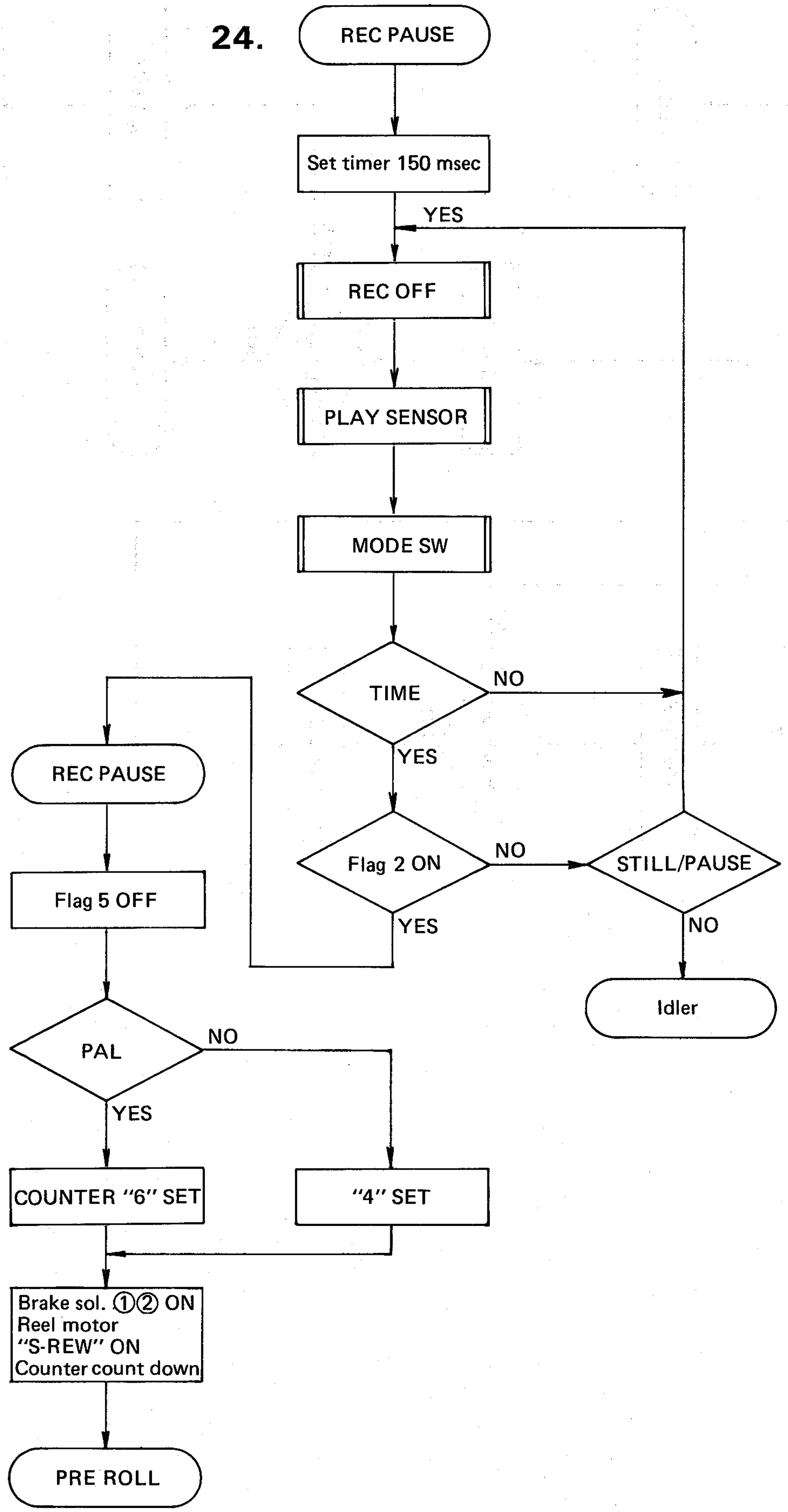
22.


PLAY SENSOR
Tape end sensro-2
YES
NO
Tape start sensor
YES
PLAY to EJECT
NO
Timer SW ON
YES
NO
STILL/PAUSE
NO
YES
REC
NO
YES
PLAY SENSOR-2
FLAG
RT
NO
Timer SW ON
YES
SLOW
YES
NO
RT
NO
Timer signal
YES
SPEED
YES
NO
STILL/PAUSE OFF
Flag 3 ON
Flag 3 OFF
Flag 3 OFF
Flag 4 ON
RT
Flag 4 OFF
PLAY to REW

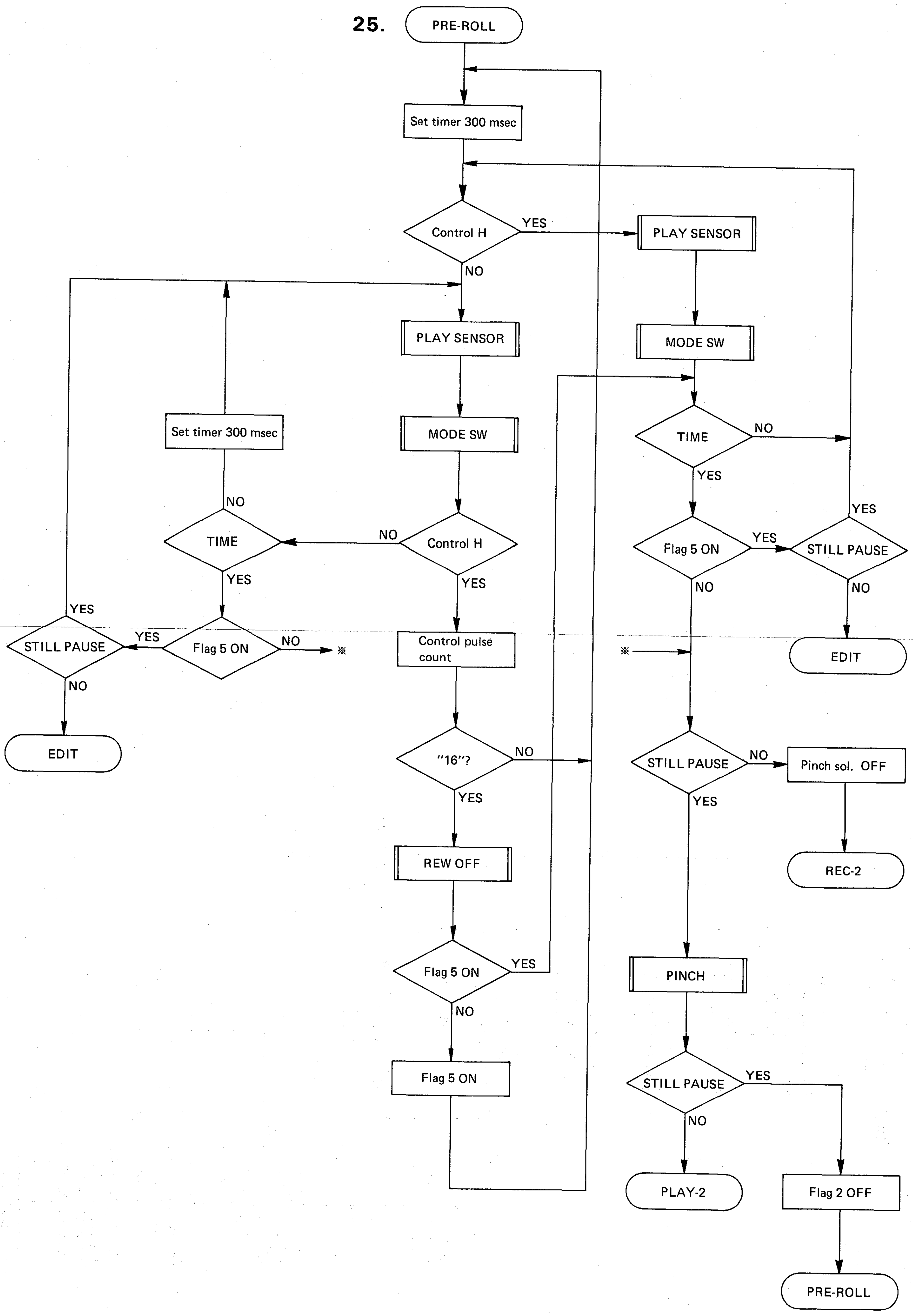
23.


REC
STILL/PAUSE?
YES
NO
Cue signal ON
Flag 2 OFF
REC 5
Counter count up
Flag 9 ON
REC/STOP ON
Set timer
approx 1 sec
RIVER
NO
TIME
YES
Tape start sensor
NO
STILL/PAUSE
YES
Flag 2 ON
YES
NO
YES
Brake sol. 2 OFF
Pinch sol. 2 OFF
Cue OFF
PINCH
STILL/PAUSE
NO
YES
STILL/PAUSE
YES
REC PAUSE
NO
REC OFF
REC ON
Flag 2 ON
PLAY SENSOR
MODE SW

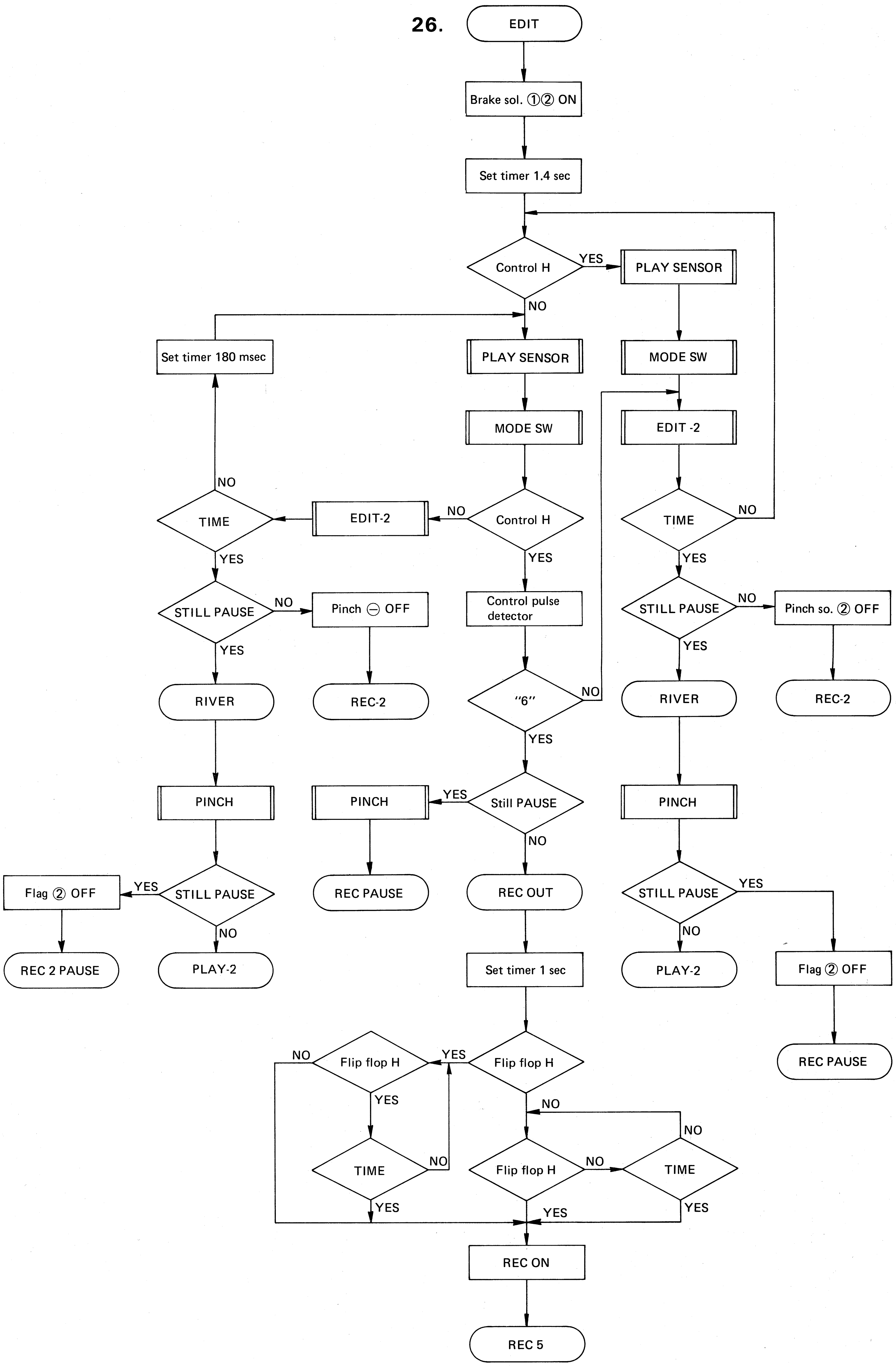
24.

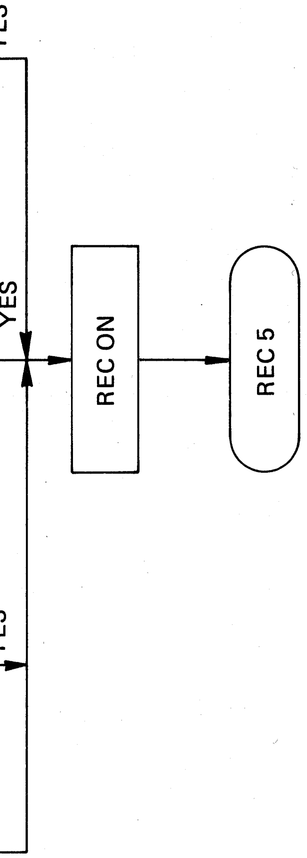

REC PAUSE
Set timer 150 msec
YES
REC OFF
PLAY SENSOR
MODE SW
TIME
NO
YES
Flag 2 ON
NO
STILL/PAUSE
NO
Idler
YES
REC PAUSE
Flag 5 OFF
PAL
NO
YES
COUNTER "6" SET
"4" SET
Brake sol. ①② ON
Reel motor
"S-REW" ON
Counter count down
PRE ROLL

25.

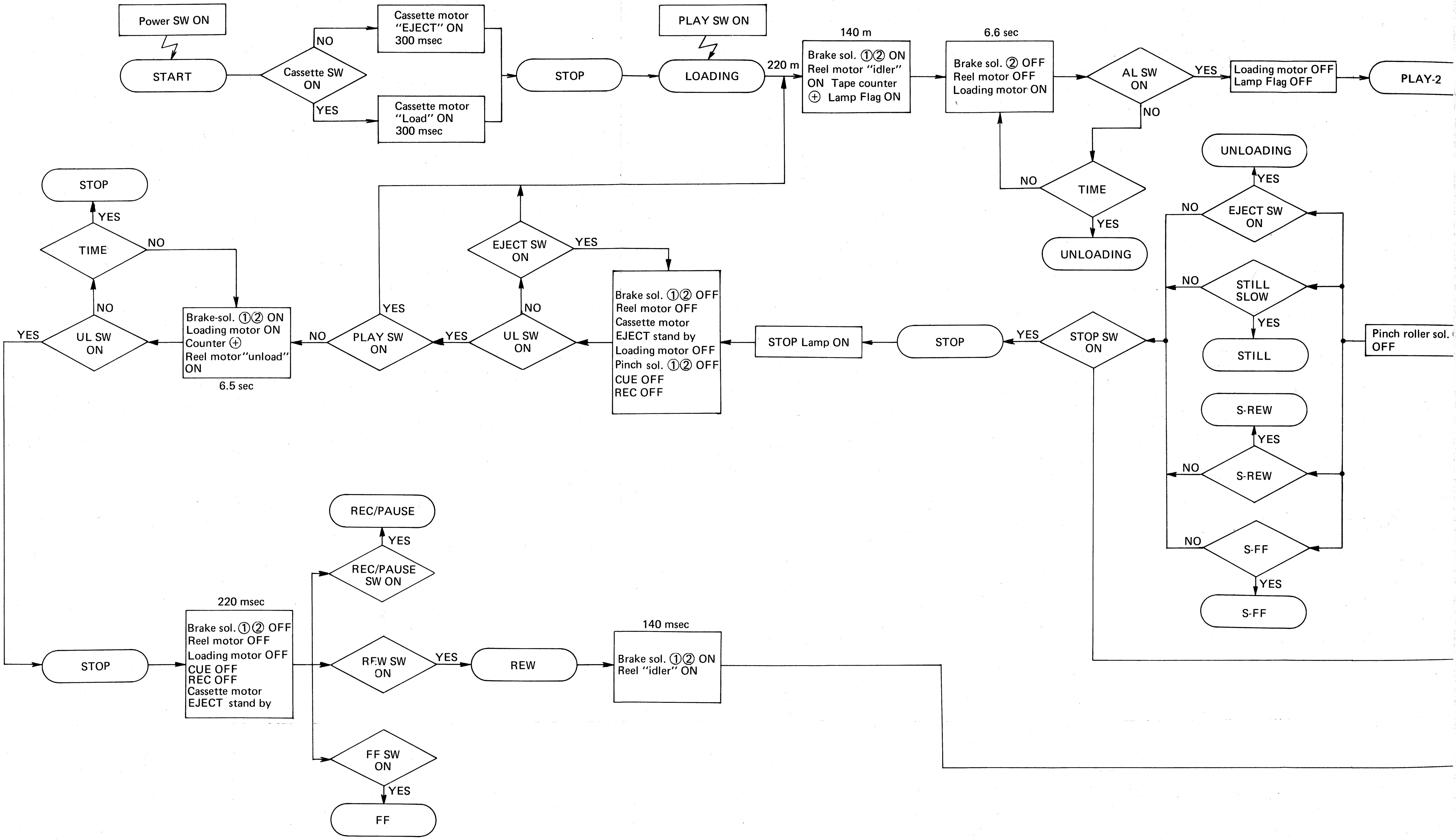

PRE-ROLL
Set timer 300 msec
Control H
YES
NO
PLAY SENSOR
MODE SW
PLAY SENSOR
MODE SW
TIME
NO
YES
Set timer 300 msec
NO
TIME
NO
Control H
YES
Flag 5 ON
YES
STILL PAUSE
YES
NO
EDIT
YES
STILL PAUSE
YES
Flag 5 ON
NO
※
Control pulse count
NO
EDIT
※
"16"?
NO
YES
STILL PAUSE
NO
Pinch sol. OFF
YES
REC-2
REW OFF
Flag 5 ON
YES
NO
PINCH
Flag 5 ON
STILL PAUSE
YES
NO
PLAY-2
Flag 2 OFF
PRE-ROLL

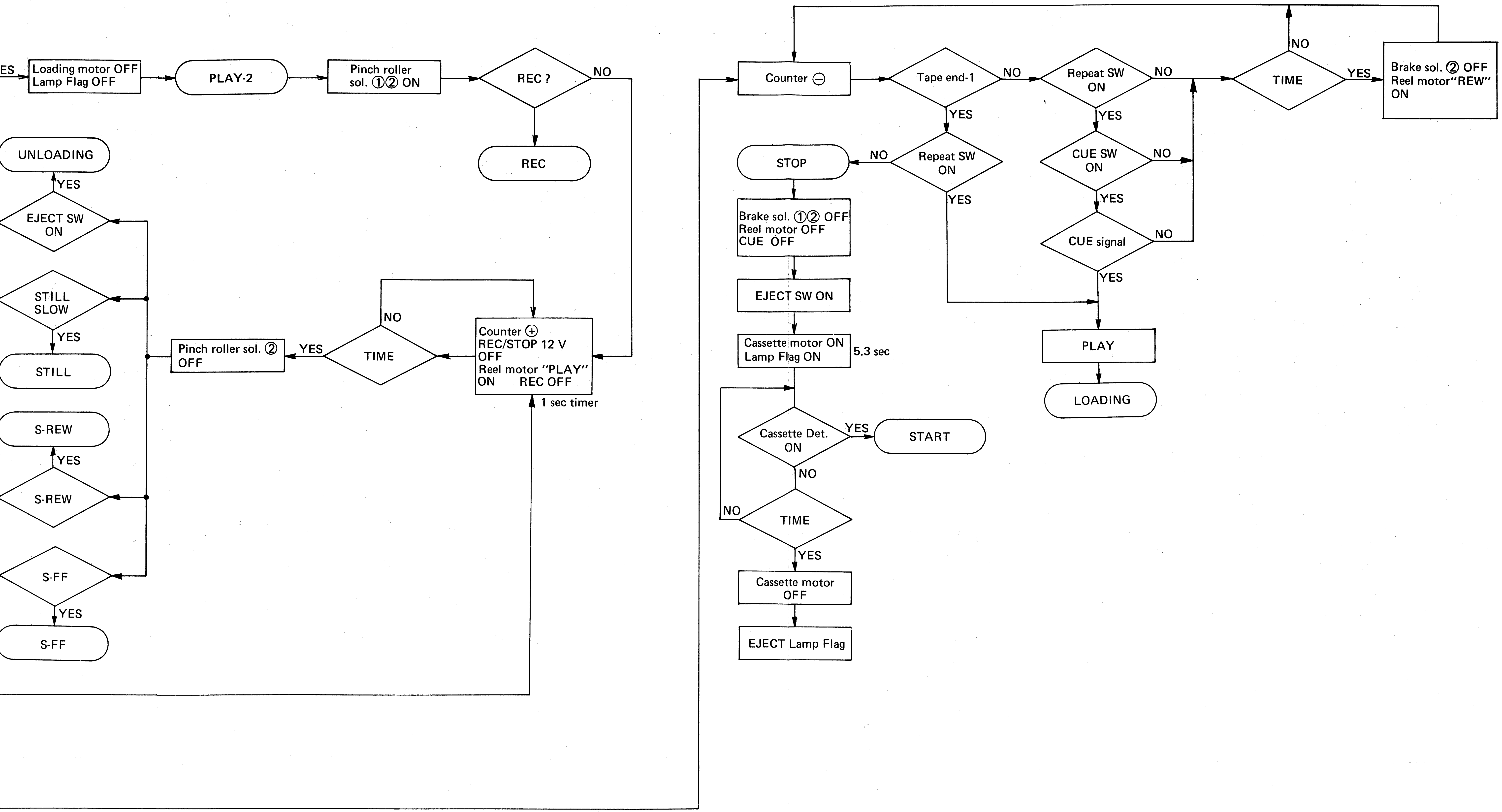
26.

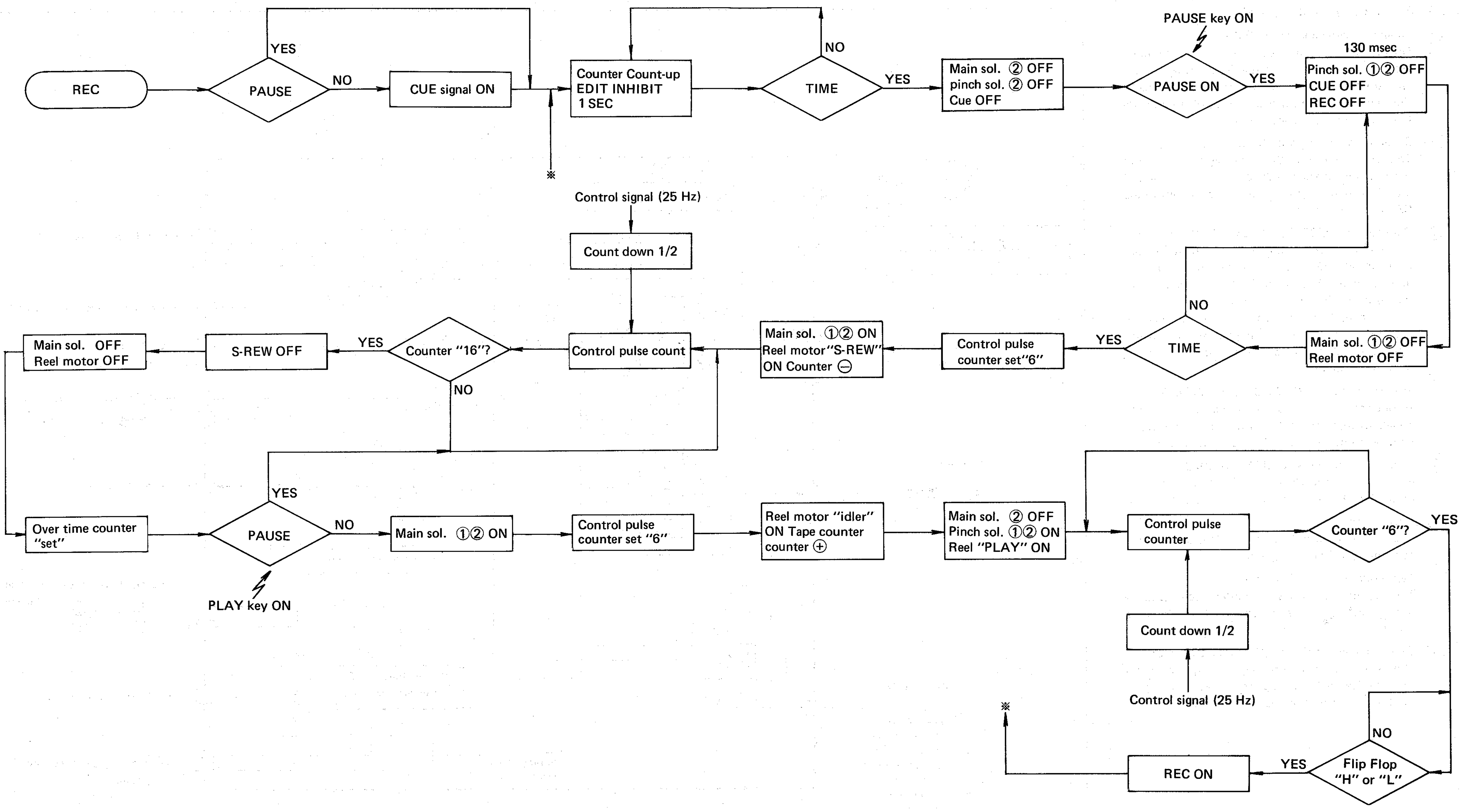

EDIT
Brake sol. ①② ON
Set timer 1.4 sec
Control H
YES
NO
PLAY SENSOR
MODE SW
EDIT -2
TIME
NO
YES
STILL PAUSE
NO
Pinch so. ② OFF
REC-2
YES
RIVER
PINCH
STILL PAUSE
YES
Flag ② OFF
REC PAUSE
NO
PLAY-2
Set timer 180 msec
PLAY SENSOR
MODE SW
Control H
NO
EDIT-2
TIME
NO
YES
STILL PAUSE
NO
Pinch ⊖ OFF
REC-2
YES
RIVER
PINCH
STILL PAUSE
YES
Flag ② OFF
REC 2 PAUSE
NO
PLAY-2
YES
Control pulse detector
"6"
NO
YES
Still PAUSE
YES
PINCH
REC PAUSE
NO
REC OUT
Set timer 1 sec
Flip flop H
YES
Flip flop H
NO
YES
TIME
NO
YES
NO
Flip flop H
NO
TIME
NO
YES
YES
REC ON
REC 5


YES
REC ON
REC 5

3.2.9 FUNCTION FLOWCHARTS


Power SW ON
START
Cassette SW ON
NO
YES
Cassette motor "EJECT" ON 300 msec
Cassette motor "Load" ON 300 msec
STOP
PLAY SW ON
LOADING
220 m
140 m
Brake sol. ①② ON
Reel motor "idler" ON
Tape counter ⊕
Lamp Flag ON
6.6 sec
Brake sol. ② OFF
Reel motor OFF
Loading motor ON
AL SW ON
YES
Loading motor OFF
Lamp Flag OFF
PLAY-2
NO
TIME
NO
YES
UNLOADING
UNLOADING
YES
EJECT SW ON
NO
STILL SLOW
NO
YES
STILL
S-REW
YES
S-REW
NO
S-FF
NO
YES
S-FF
Pinch roller sol. OFF
STOP SW ON
YES
STOP
STOP Lamp ON
Brake sol. ①② OFF
Reel motor OFF
Cassette motor EJECT stand by
Loading motor OFF
Pinch sol. ①② OFF
CUE OFF
REC OFF
EJECT SW ON
YES
NO
UL SW ON
YES
PLAY SW ON
YES
NO
Brake-sol. ①② ON
Loading motor ON
Counter ⊕
Reel motor "unload" ON
6.5 sec
UL SW ON
NO
YES
TIME
NO
YES
STOP
STOP
220 msec
Brake sol. ①② OFF
Reel motor OFF
Loading motor OFF
CUE OFF
REC OFF
Cassette motor EJECT stand by
REC/PAUSE SW ON
YES
REC/PAUSE
REW SW ON
YES
REW
140 msec
Brake sol. ①② ON
Reel "idler" ON
FF SW ON
YES
FF


ES
Loading motor OFF
Lamp Flag OFF
PLAY-2
Pinch roller sol. ①② ON
REC ?
NO
REC
UNLOADING
YES
EJECT SW ON
STILL SLOW
YES
STILL
Pinch roller sol. ② OFF
YES
TIME
NO
Counter ⊕
REC/STOP 12 V OFF
Reel motor "PLAY" ON REC OFF
1 sec timer
S-REW
YES
S-REW
S-FF
YES
S-FF
Counter ⊖
Tape end-1
NO
YES
Repeat SW ON
NO
YES
TIME
NO
YES
Brake sol. ② OFF
Reel motor "REW" ON
STOP
NO
Repeat SW ON
YES
CUE SW ON
NO
YES
CUE signal
NO
YES
Brake sol. ①② OFF
Reel motor OFF
CUE OFF
EJECT SW ON
Cassette motor ON
Lamp Flag ON
5.3 sec
PLAY
LOADING
Cassette Det. ON
YES
START
NO
NO
TIME
YES
Cassette motor OFF
EJECT Lamp Flag


REC
PAUSE
YES
NO
CUE signal ON
Counter Count-up
EDIT INHIBIT
1 SEC
TIME
NO
YES
Main sol. ② OFF
pinch sol. ② OFF
Cue OFF
PAUSE key ON
PAUSE ON
YES
130 msec
Pinch sol. ①② OFF
CUE OFF
REC OFF
※
Control signal (25 Hz)
Count down 1/2
NO
Main sol. OFF
Reel motor OFF
S-REW OFF
YES
Counter "16"?
Control pulse count
Main sol. ①② ON
Reel motor "S-REW"
ON Counter ⊖
Control pulse
counter set "6"
YES
TIME
Main sol. ①② OFF
Reel motor OFF
NO
YES
Over time counter
"set"
PAUSE
NO
PLAY key ON
Main sol. ①② ON
Control pulse
counter set "6"
Reel motor "idler"
ON Tape counter
counter ⊕
Main sol. ② OFF
Pinch sol. ①② ON
Reel "PLAY" ON
Control pulse
counter
Counter "6"?
YES
Count down 1/2
Control signal (25 Hz)
※
NO
REC ON
YES
Flip Flop
"H" or "L"

3.2.10 Block diagram description

① Parallel to serial encoder (M50115AP)
Operation mode data from the function switches are in the form of 7 bit serial digital signals. These are supplied to the mechanism control circuit. The same serial data signals are also obtained from the infrared remote control unit.

② Serial to parallel decoder (IC38 M50117AP)
This circuit converts the serial digital code from the function board or infrared remote control unit into 7 bit data. The converted data are sent to the CPU as the mode signal.

③ Data selector (IC23, 24, 25, 26 TC-4539 x 4)
This section selects from among the digital signals from the various sensors and the serial to parallel decoder, converts them to 4 bit code, and supplies the result to CPU ports A and B.
A 2 bit code from CPU port I is used for selecting the input data which are supplied to the output. Operation data input is 8 bits, and 24 sensor inputs are provided.

④ Mechanism control CPU (IC1 μPD553C-072)
A one-chip 4 bit microcomputer in which the signals of input ports A and B, and output port I control the output ports C, D, E, F, G, and H.

⑤ BCD to decimal decoder (IC11 TC4028)
4 bit data from CPU port C are converted to decimal code for controlling the function LEDs.

⑥ Reel motor decoder
The 4 bit data output from port D is decoded for controlling reel motor rotation.

⑦ Tape counter (IC13 TC4029)
The presettable up/down counter circuit detects supply reel disk rotation and controls the tape counter.

⑧ Tape remaining indicator (IC2 μPD654C-036)
This is a CPU for controlling the tape remaining LED indication. Take-up and supply reel disk rotation is detected and counting performed.

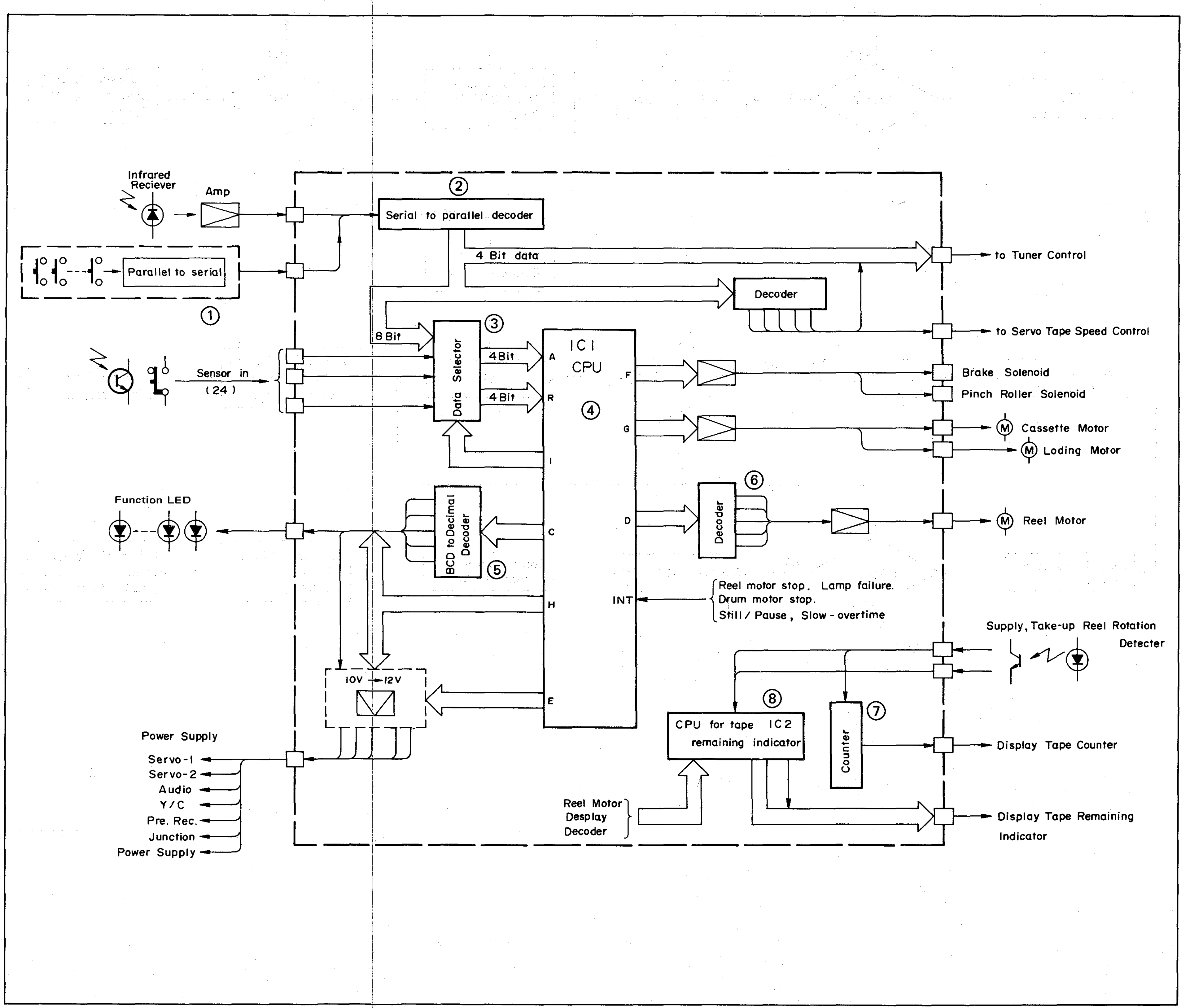

Infrared Reciever
Amp
②
Serial to parallel decoder
Parallel to serial
①
4 Bit data
Decoder
to Tuner Control
to Servo Tape Speed Control
8 Bit
③
Data Selector
4 Bit
4 Bit
A
R
IC1
CPU
④
F
G
I
C
D
H
INT
E
Sensor in
(24)
Brake Solenoid
Pinch Roller Solenoid
M Cassette Motor
M Loding Motor
⑥
Decoder
M Reel Motor
Function LED
BCD to Decimal Decoder
⑤
Reel motor stop, Lamp failure.
Drum motor stop.
Still / Pause, Slow - overtime
Supply, Take-up Reel Rotation Detecter
10V → 12V
⑧
CPU for tape IC2 remaining indicator
⑦
Counter
Display Tape Counter
Power Supply
Servo-1
Servo-2
Audio
Y/C
Pre. Rec.
Junction
Power Supply
Reel Motor Desplay Decoder
Display Tape Remaining Indicator

Fig. 3-49 Mecha-com Block diagram

3.2.11 Circuit description

1. **Function switch circuit**
   This circuit converts the mode signal from the function switches into serial data for supply to the mechacon circuit. In the mechacon circuit, the serial data are converted to parallel and sent to the CPU for mode control.

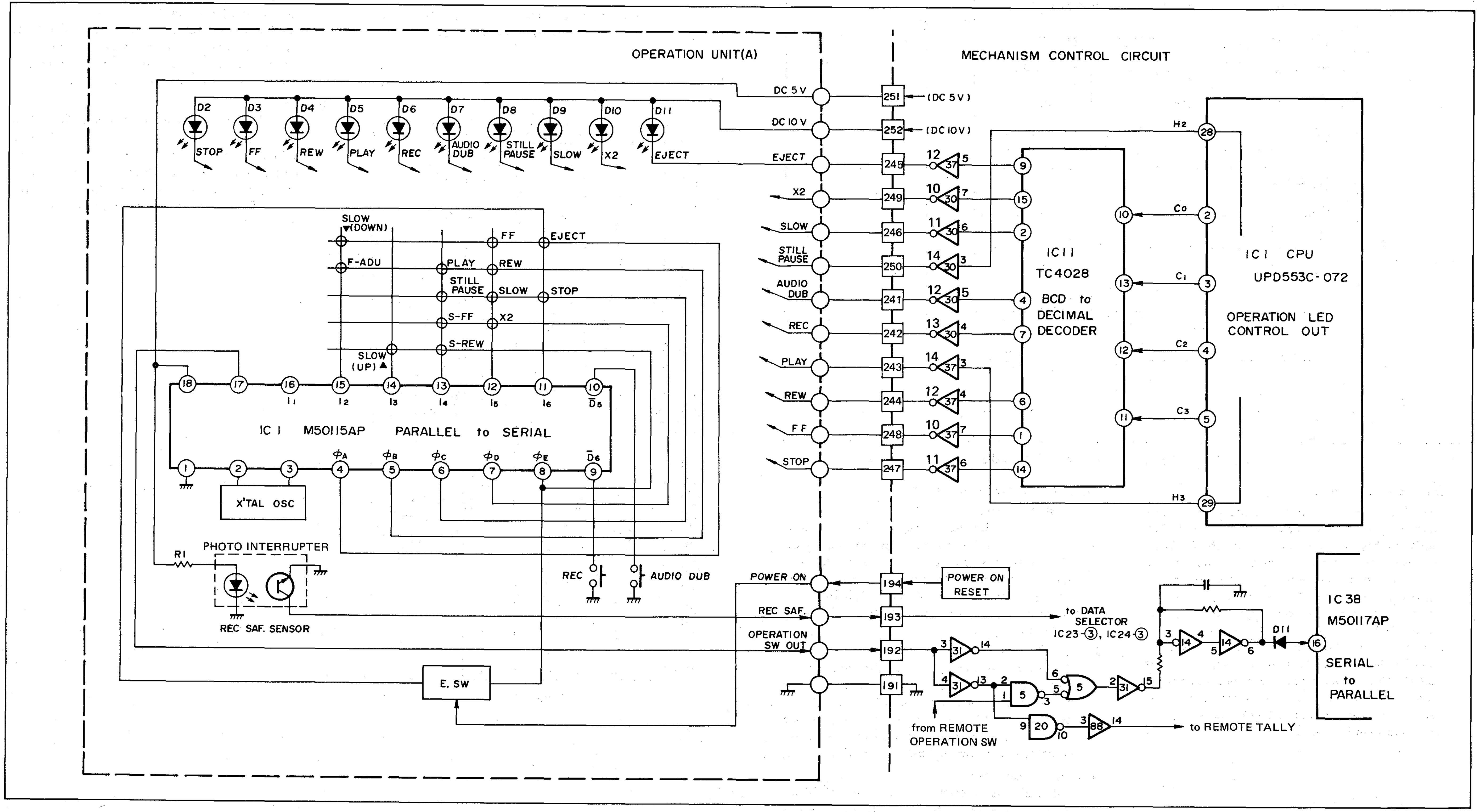

OPERATION UNIT(A)
MECHANISM CONTROL CIRCUIT
D2 STOP
D3 FF
D4 REW
D5 PLAY
D6 REC
D7 AUDIO DUB
D8 STILL PAUSE
D9 SLOW
D10 X2
D11 EJECT
SLOW ▼(DOWN)
F-ADU
FF
EJECT
PLAY
REW
STILL PAUSE
SLOW
STOP
S-FF
X2
S-REW
SLOW (UP) ▲
IC 1 M50115AP PARALLEL to SERIAL
I1 I2 I3 I4 I5 I6 D̄5
ΦA ΦB ΦC ΦD ΦE D̄6
X'TAL OSC
R1
PHOTO INTERRUPTER
REC SAF. SENSOR
REC
AUDIO DUB
E. SW
DC 5 V
DC 10 V
EJECT
X2
SLOW
STILL PAUSE
AUDIO DUB
REC
PLAY
REW
FF
STOP
POWER ON
REC SAF.
OPERATION SW OUT
251 (DC 5 V)
252 (DC 10 V)
245
249
246
250
241
242
243
244
248
247
194
193
192
191
POWER ON RESET
IC11 TC4028 BCD to DECIMAL DECODER
IC1 CPU UPD553C-072
OPERATION LED CONTROL OUT
H2
H3
C0
C1
C2
C3
to DATA SELECTOR IC23-③, IC24-③
from REMOTE OPERATION SW
to REMOTE TALLY
D11
IC38 M50117AP
SERIAL to PARALLEL

Fig. 3-50 Function SW circuit

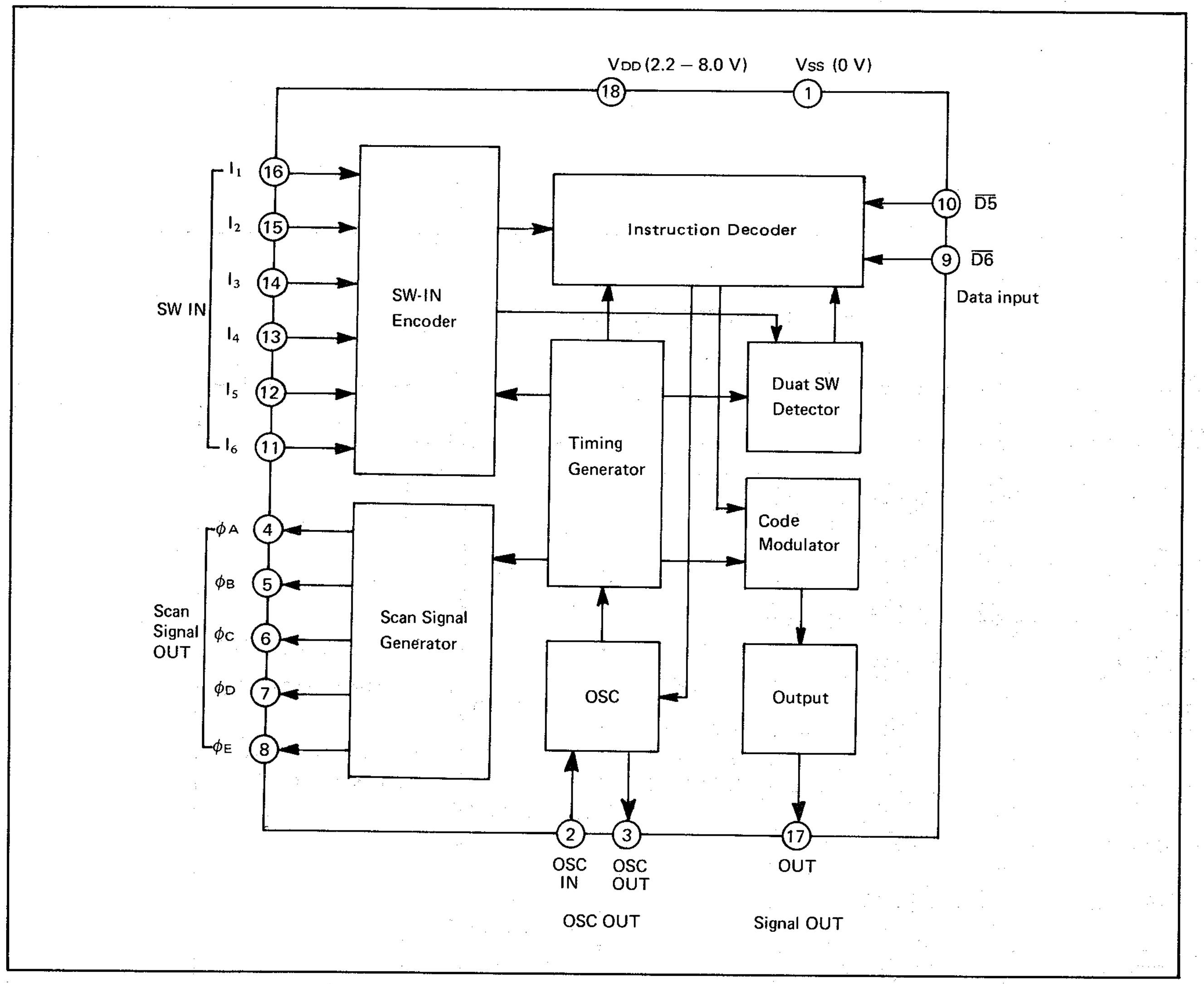


Fig. 3-51 Parallel to serial encoder (M50115AP)

Parallel to serial encoder

Serial data for each mode are produced by this circuit when the front panel or remote controller function keys are pressed. The IC (M50115AP) controls the infrared transmitter. Internally, it consists of oscillator, timing generator, scan signal generator, mode switch input encoder, instruction decoder, dual switch detector, code modulator and output buffer.

Inputs are a maximum 6 x 5 switch matrix and $\overline{D}5$ and $\overline{D}6$ data. Instructions are transferred via a 10 bit PCM (pulse code modulation) code. Power consumption is reduced by stopping the oscillator in absence of a switch input. Block diagram of the IC is shown in Fig. 3-xx.

M50115A Parallel to serial encoder

1. Oscillator circuit
   As shown in the circuit diagram, the IC contains an internal CMOS inverter and bias resistance. The oscillator is composed of a ceramic resonator and two capacitors. By using an oscillation frequency of 480 kHz, the transmitted signal carrier becomes 40 kHz. The oscillator stops in absence of a switch input.
2. Switch inputs
   A 5 x 5 matrix is composed of switch inputs I2 to I6 and scan outputs ϕ A to ϕ E. Instructions can be transmitted by data inputs $\overline{D}5$ and $\overline{D}6$. If two or more switch inputs are present, output code transfer stops. However, dual switch inputs are accepted in the cases of REC and AF-REC.
3. Transmission code
   The transmission code is in the form of 10 bit serial data (K0 to K2 and D0 to D6). The 3 bits of K0 to K2 are the transmit/receive key code and are set to "100" to avoid interference with other remote control units. Switch operations correspond to the 5 bits of D0 to D4. Data inputs $\overline{D}5$ (AUDIO DUB) and $\overline{D}6$ (REC) determine the 2 bits of D5 and D6.
   Table 3-7 shows the relationship between the transmission code designation and the transmission code.
   In order to avoid operating error, all "0" and all "1" transmission codes are not employed.

Code No.	Transmission Code					Operation SW
	D_0	D_1	D_2	D_3	D_4	
A - 1	1	0	0	0	0	EJECT
A - 2	0	1	0	0	0	
A - 3	1	1	0	0	0	STOP
A - 4	0	0	1	0	0	
A - 5	1	0	1	0	0	
A - 6	0	1	1	0	0	FF
A - 7	1	1	1	0	0	REW
A - 8	0	0	0	1	0	SLOW
A - 9	1	0	0	1	0	X 2 SPEED
A - 10	0	1	0	1	0	
A- 11	1	1	0	1	0	
A - 12	0	0	1	1	0	PLAY
A - 13	1	0	1	1	0	STILL/PAUSE
A - 14	0	1	1	1	0	SEARCH-FF
A - 15	1	1	1	1	0	SEARCH-REW
B - 0	0	0	0	0	1	
B - 1	1	0	0	0	1	
B - 2	0	1	0	0	1	
B - 3	1	1	0	0	1	
B - 4	0	0	1	0	1	SLOW (UP)
B - 5	1	0	1	0	1	SLOW(Down)
- 6	0	1	1	0	1	Frame Adv.
B - 7	1	1	1	0	1	
B - 8	0	0	0	1	1	
B - 9	1	0	0	1	1	
B - 10	0	1	0	1	1	
B - 11	0	1	0	1	1	
B - 12	0	0	1	1	1	
B - 13	1	0	1	1	1	
B - 14	0	1	1	1	1	

Table 3-7

4. Transmission code format
   The 480 kHz oscillator frequency results in a transmission frequency of 40 kHz. High level duration of each pulse is 0.25 msec and 10 pulses at 40 kHz form the high level of the transmission signal. Distinguishing between binary "1" and "0" is performed by the time spacing between successive pulses. As shown in Fig. 3-52, the space is 1 msec for "0" and 2 msec for "1".
   A 10 bit code composes one instruction word (i.e., 11 pulses). When a function switch is pressed, data are transmitted in a 24 msec period. Transmission data for each mode are shown in Table 3-8.
5. Data inputs
   When switches are open, data inputs $\overline{D}5$ and $\overline{D}6$ are composed of ϕ A to ϕ E and I1 to I6. Pressing a function switch produces high level, and transmission codes D5 and D6 become "0". In other words, when $\overline{D}5$ and $\overline{D}6$ are low, pressing the REC or AF-REC switch yields transmission code output "1".

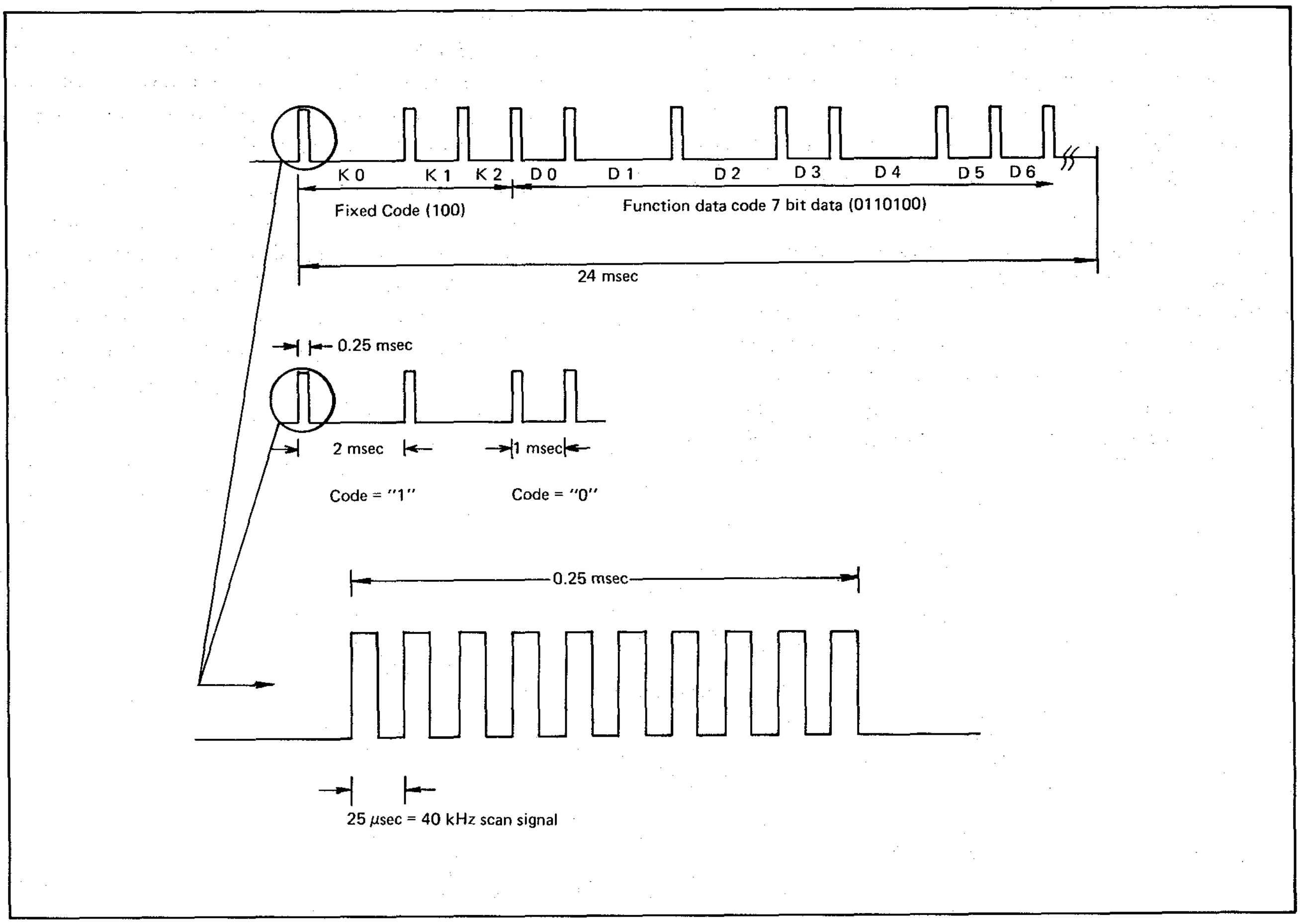


Fig. 3-52 Serial code

	D6	D5	D4	D3	D2	D1	D0			D6	D5	D4	D3	D2	D1	D0
	0	0	0	0	0	0	0			0	1	0	0	0	0	0
Eject	0	0	0	0	0	0	1	A-1		0	1	0	0	0	0	1
	0	0	0	0	0	1	0	A-2		0	1	0	0	0	1	0
Stop	0	0	0	0	0	1	1	A-3		0	1	0	0	0	1	1
	0	0	0	0	1	0	0	A-4		0	1	0	0	1	0	0
Power ON	0	0	0	0	1	0	1	A-5		0	1	0	0	1	0	1
F. F.	0	0	0	0	1	1	0	A-6		0	1	0	0	1	1	0
Rewind	0	0	0	0	1	1	1	A-7		0	1	0	0	1	1	1
Slow	0	0	0	1	0	0	0	A-8		0	1	0	1	0	0	0
X 2	0	0	0	1	0	0	1	A-9		0	1	0	1	0	0	1
Power OFF	0	0	0	1	0	1	0	A 10		0	1	0	1	0	1	0
	0	0	0	1	0	1	1	A-11		0	1	0	1	0	1	1
Play	0	0	0	1	1	0	0	A-12	Af.Rec. & Play	0	1	0	1	1	0	0
Still / Pause	0	0	0	1	1	0	1	A-13	Af. Rec. & Pause	0	1	0	1	1	0	1
Search F.F.	0	0	0	1	1	1	0	A-14		0	1	0	1	1	1	0
Search Rewind	0	0	0	1	1	1	1	A-15		0	1	0	1	1	1	1
T V	0	0	1	0	0	0	0	B-0		0	1	1	0	0	0	0
Video	0	0	1	0	0	0	1	B-1		0	1	1	0	0	0	1
	0	0	1	0	0	1	0	B-2		0	1	1	0	0	1	0
	0	0	1	0	0	1	1	B-3		0	1	1	0	0	1	1
Slow Speed	0	0	1	0	1	0	0	B-4		0	1	1	0	1	0	0
Slow Speed	0	0	1	0	1	0	1	B-5		0	1	1	0	1	0	1
Frame Advance	0	0	1	0	1	1	0	B-6		0	1	1	0	1	1	0
Counter Reset	0	0	1	0	1	1	1	B-7		0	1	1	0	1	1	1
	0	0	1	1	0	0	0	B-8		0	1	1	1	0	0	0
	0	0	1	1	0	0	1	B-9		0	1	1	1	0	0	1
	0	0	1	1	0	1	0	B-10		0	1	1	1	0	1	0
	0	0	1	1	0	1	1	B-11		0	1	1	1	0	1	1
	0	0	1	1	1	0	0	B-12		0	1	1	1	1	0	0
	0	0	1	1	1	0	1	B-13		0	1	1	1	1	0	1
	0	0	1	1	1	1	0	B-14		0	1	1	1	1	1	0
	0	0	1	1	1	1	1			0	1	1	1	1	1	1

	D6	D5	D4	D3	D2	D1	D0			D6	D5	D4	D3	D2	D1	D0
	1	0	0	0	0	0	0			1	1	0	0	0	0	0
Clock Mode	1	0	0	0	0	0	1	A-1		1	1	0	0	0	0	1
Counter Mode	1	0	0	0	0	1	0	A-2		1	1	0	0	0	1	0
Prog. Mode	1	0	0	0	0	1	1	A-3		1	1	0	0	0	1	1
Select	1	0	0	0	1	0	0	A-4		1	1	0	0	1	0	0
Set	1	0	0	0	1	0	1	A-5		1	1	0	0	1	0	1
Cancel	1	0	0	0	1	1	0	A-6		1	1	0	0	1	1	0
Prog.	1	0	0	0	1	1	1	A-7		1	1	0	0	1	1	1
Repeat	1	0	0	1	0	0	0	A-8		1	1	0	1	0	0	0
Clock Adjust	1	0	0	1	0	0	1	A-9		1	1	0	1	0	0	1
	1	0	0	1	0	1	0	A-10		1	1	0	1	0	1	0
	1	0	0	1	0	1	1	A-11		1	1	0	1	0	1	1
	1	0	0	1	1	0	0	A-12	Rec. & Play	1	1	0	1	1	0	0
	1	0	0	1	1	0	1	A-13	Rec. & Pause	1	1	0	1	1	0	1
Prog. No. Ex.	1	0	0	1	1	1	0	A-14		1	1	0	1	1	1	0
Channel No.16	1	0	0	1	1	1	1	A-15		1	1	0	1	1	1	1
No. 1	1	0	1	0	0	0	0	B-0		1	1	1	0	0	0	0
No.2	1	0	1	0	0	0	1	B-1		1	1	1	0	0	0	1
No.3	1	0	1	0	0	1	0	B-2		1	1	1	0	0	1	0
No.4	1	0	1	0	0	1	1	B-3		1	1	1	0	0	1	1
No.5	1	0	1	0	1	0	0	B-4		1	1	1	0	1	0	0
No.6	1	0	1	0	1	0	1	B-5		1	1	1	0	1	0	1
No.7	1	0	1	0	1	1	0	B-6		1	1	1	0	1	1	0
No.8	1	0	1	0	1	1	1	B-7		1	1	1	0	1	1	1
No.9	1	0	1	1	0	0	0	B-8		1	1	1	1	0	0	0
No.10	1	0	1	1	0	0	1	B-9		1	1	1	1	0	0	1
No.11	1	0	1	1	0	1	0	B-10		1	1	1	1	0	1	0
No.12	1	0	1	1	0	1	1	B-11		1	1	1	1	0	1	1
No.13	1	0	1	1	1	0	0	B-12		1	1	1	1	1	0	0
No.14	1	0	1	1	1	0	1	B-13		1	1	1	1	1	0	1
No.15	1	0	1	1	1	1	0	B-14		1	1	1	1	1	1	0
	1	0	1	1	1	1	1			1	1	1	1	1	1	1

Table 3-8

2. Serial to parallel decoder
IC38 (M50117AP) and peripheral circuits

The 10 bit function code is obtained from pin 17 of front operation board IC1 (M50115AP). This goes to terminal 192 of the mechanism control circuit. A serial operation pulse is then supplied through a gate circuit to IC38 pin 16.

IC38 (M50117AP) controls the receiver section of the infrared remote control system. The IC contains an oscillator, timing generator, receive mode detector, demodulator, serial data processor, shift register, receive input, auto clear and error prevention circuits. Signals from the operation switches or remote controller are identified and sent to the CPU as 8 bit parallel data.

1. Oscillator circuit
The M50117AP contains a CMOS inverter and bias resistance. A ceramic resonator and two capacitors compose the oscillator circuit. Oscillation frequency is 480 kHz.

2. Receive input and demodulator
The transmitted 10 bit serial data are applied to input $\overline{SI}$ of IC38 pin 16. From the input circuit, the signal goes to the demodulator, where the pulse signal interval is detected. The demodulator converts the signal into digital code. The relationships among the pin 16 input waveform, code and data are shown in Fig. 3-54.

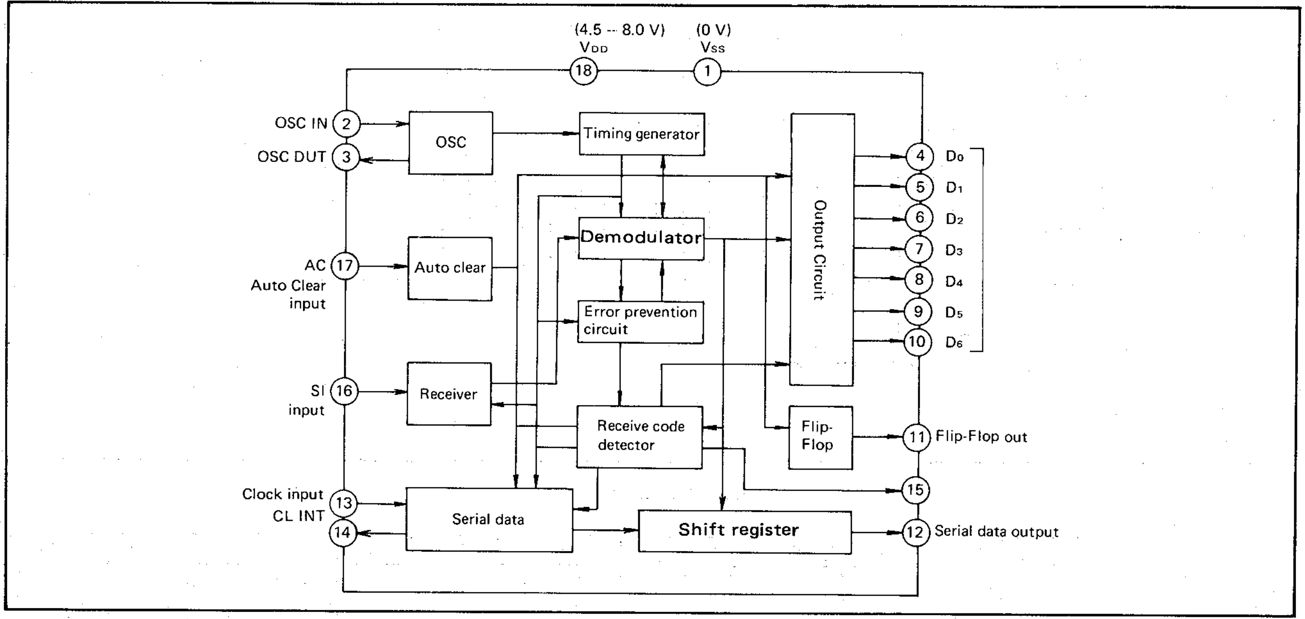

(4.5 -- 8.0 V)
VDD
(0 V)
Vss
18
1
OSC IN 2
OSC DUT 3
OSC
Timing generator
Demodulator
Error prevention circuit
Output Circuit
AC 17
Auto Clear input
Auto clear
SI 16
input
Receiver
Receive code detector
Flip-Flop
Clock input 13
CL INT 14
Serial data
Shift register
4 D0
5 D1
6 D2
7 D3
8 D4
9 D5
10 D6
11 Flip-Flop out
15
12 Serial data output

Fig. 3-53 Seriat to Parallel decorder

Seriat to Parallel

	INT	D_0	D_1	D_2	D_3	D_4	D_5	D_6
EJECT	0	0	1	1	1	1	1	1
STOP	0	0	0	1	1	1	1	1
fFF	0	1	0	0	1	1	1	1
REW	0	0	0	0	1	1	1	1
SLOW	0	1	1	1	0	1	1	1
X 2	0	0	1	1	0	1	1	1
PLAY	0	1	1	0	0	1	1	1
STILL PAUSE	0	0	1	0	0	1	1	1
S-REW	0	0	0	0	0	1	1	1
S-FF	0	1	0	0	0	1	1	1
PLAY REC REC	0	1	1	0	0	1	0	0
P⌐AY AF-REC	0	1	1	0	0	1	0	1

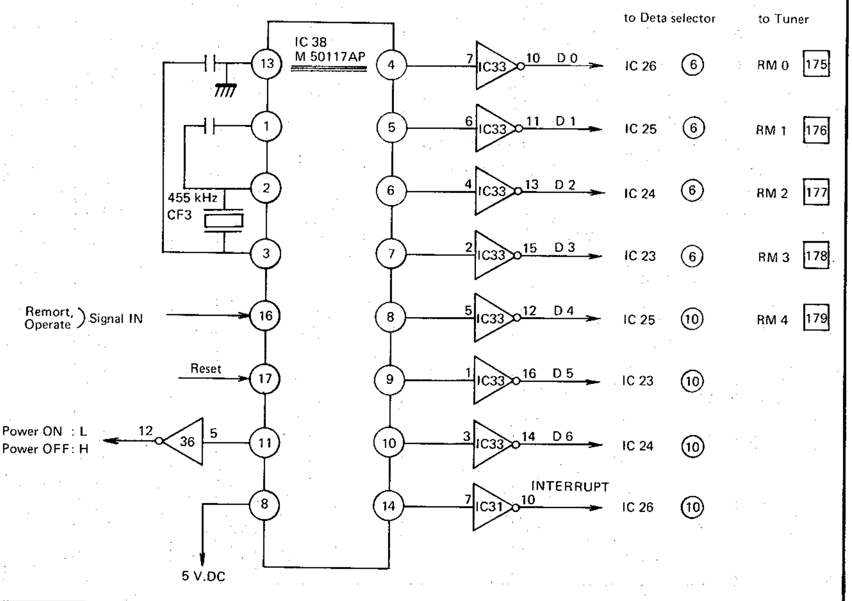
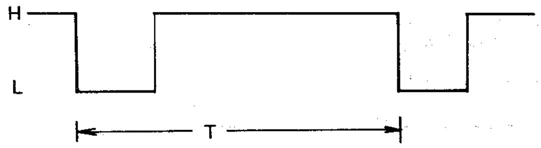

IC 38
M 50117AP
13
1
2
3
16
17
11
8
4
5
6
7
8
9
10
14
455 kHz
CF3
Remort, Operate) Signal IN
Reset
Power ON : L
Power OFF: H
12
36
5
5 V.DC
to Deta selector
to Tuner
7 IC33 10 D 0 IC 26 ⑥ RM 0 175
6 IC33 11 D 1 IC 25 ⑥ RM 1 176
4 IC33 13 D 2 IC 24 ⑥ RM 2 177
2 IC33 15 D 3 IC 23 ⑥ RM 3 178
5 IC33 12 D 4 IC 25 ⑩ RM 4 179
1 IC33 16 D 5 IC 23 ⑩
3 IC33 14 D 6 IC 24 ⑩
INTERRUPT
7 IC31 10 IC 26 ⑩

Fig. 3-54 Serial to parallel decorder (IC38)



T between 0.4 msec and 1.6 msec yields code "0", data "L".
T between 1.6 msec and 3.2 msec yields code "1", data "H".

Fig. 3-55

When the pulse interval at pin 16 exceeds 3.2 msec, this is interpreted as completion of 1 word (1 instruction). An interval in excess of approx. 50 msec is interpreted as transmission complete and all outputs assume standby.

3. Error prevention circuit
   If the low period of the signal at pin 16 is less than 50 to 100 μsec, it is not interpreted as a transmitted signal. An input pulse interval of less than 0.4 msec resets the standby mode, preventing erroneous operation. The standby mode is also reset if all inputs are "0" or "1".
4. Received code, data and flipflop outputs
   Data outputs D0 to D6 correspond to D0 to D6 of the input signal transmission code. The outputs are low at code "0" and high at code "1". When D6 to D0 compose "0000101" (power on code), flipflop output FF goes high. This high output from pin 11 resets the CPUs of IC1 and IC2. The flipflop output goes low when the transmission code is "0001010".
5. Output circuit
   Seven bit data outputs are obtained from pins 4 to 10. The parallel data are sent to the data selector as the mode signal.

3. Infrared receiver board

1. Receiver photo diode (PU49491)
   A photo diode is used as the infrared receiver element. It features maximum sensitivity at the same wavelength (940 nanometers) as the transmitter infrared LED, high sensitivity and wide dynamic range.

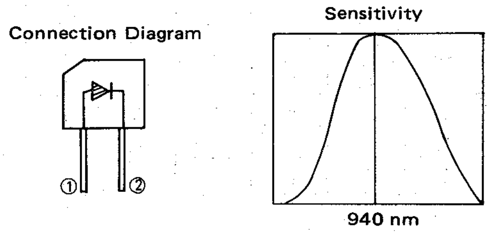


Fig. 3-56

2. Preamp IC1 (TDA4050)
   The infrared receiver preamp IC consists of amplifier, opamp (operational amplifier), resonator, AGC (automatic gain control) and comparator circuits. It is designed to produce a stabilized output. The signal from the photo diode is amplified and supplied to the mechanism control circuit as the mode signal.
   Generally, the radiated infrared energy decreases with the square of the distance. Thus, at a transmitting distance range of from 0 to about 20 meters, the received signal level varies by as much as a factor of 10^5. Fig. 3-xx shows the spectral sensitivity and directionality of the photo diode. As can be noted, the received infrared signal sensitivity is influenced by the distance and direction of the transmitter.

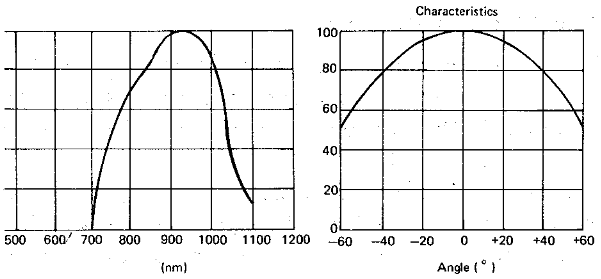


Fig. 3-57

The 40 kHz PCM signal is first processed according to its strength or weakness. A strong signal is limited by the D2 circuit added prior to the IC1 preamp input. Conversely, a signal below the threshold level is amplified by an FET (field effect transistor) amplifier and applied to IC8 pin 8.
As indicated in the block diagram, a fixed output level is produced from the AGC, opamp and resonator circuits. Due to the high speed of the IC internal control, adequate response speed is available for single code instructions. However, in order to avoid operating error, the instructions are transmitted twice, allowing full control to be obtained before the start of the second instruction. Preamp receiving mode is controlled by a 3 bit key code transmitted before the instruction code. The output and inverted input of the opamp are obtained from pins 4 and 5. A 40 kHz parallel resonator circuit produces a PCM signal in the area of 40 kHz. This signal is obtained as a 50% duty pulse from pin 3 and sent as the remote control signal input to terminal 72 of the mechanism control circuit.

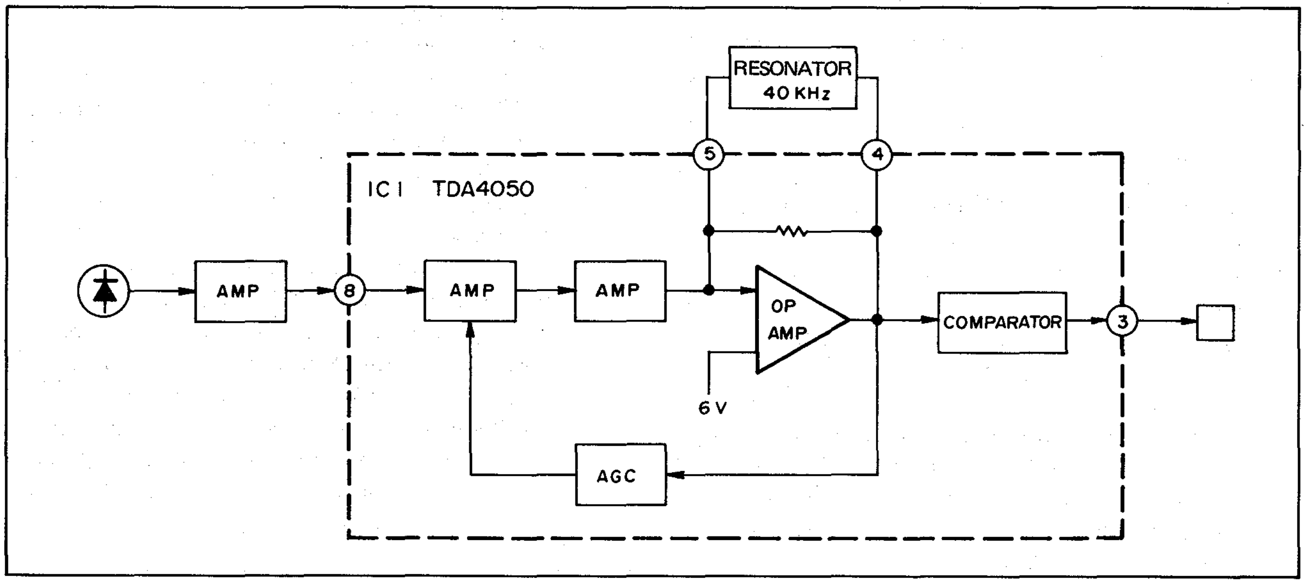


Fig. 3-58 Block diagram of infrared receiver (TDA4050)

4. BCD to decimal decoder

IC11 (TC4028) converts the 4 bit signal from port C of IC1 CPU to base 10 code and controls lighting of the operation LEDs. Data output of IC1 port C is shown in Table 3-xx.

This output is converted to base 10 code by IC11, then inverted and supplied to the operation board LEDs. Input and output states for each mode of IC11 are indicated in Fig. 3-58.

	$C_0$②	$C_1$③	$C_2$④	$C_3$⑤
OFF	L	L	L	L
STOP	H	L	L	L
SLOW	L	H	L	L
X 2	H	H	H	L
FF	L	H	H	L
REW	H	L	H	L
REC	L	H	H	L
AF-REC	H	H	H	L
EJECT	L	L	L	H

Table 3-9 Output of IC-1(CPU) C port

5. Data selector circuit

Four ICs (TC4539) compose the data selector. Inputs from the sensors and switches are connected to the 8 x 4 = 32 line terminals (30 lines are actually used) and mechanical states are continuously monitored. 4 bit x 2 signals are selected and supplied to ports A and B of IC1 CPU.

The TC4539 is a two line data selector. Data are selected by common control inputs A and B. The signal inputs at pins 3 to 6 are selected by control inputs A and B (pins 14 and 2) and supplied to pin 7 output. Likewise, the 4 inputs at pins 10 to 13 are selected and appear at output pin 9. The truth table is indicated in Fig. 3-xx.

	INPUT				OUTPUT									
MODE	⑪	⑫	⑬	⑩	③	⑭	②	⑮	①	⑥	⑦	④	⑨	⑤
OFF	L	L	L	L	Ⓗ	L	L	L	L	L	L	L	L	L
STOP	L	L	L	Ⓗ	L	Ⓗ	L	L	L	L	L	L	L	L
SLOW	L	L	Ⓗ	L	L	L	Ⓗ	L	L	L	L	L	L	L
X 2	L	L	Ⓗ	Ⓗ	L	L	L	Ⓗ	L	L	L	L	L	L
FF	L	Ⓗ	L	L	L	L	L	L	Ⓗ	L	L	L	L	L
REW	L	Ⓗ	L	Ⓗ	L	L	L	L	L	Ⓗ	L	L	L	L
REC	L	Ⓗ	Ⓗ	L	L	L	L	L	L	L	Ⓗ	L	L	L
AF-REC	L	Ⓗ	Ⓗ	Ⓗ	L	L	L	L	L	L	L	Ⓗ	L	L
EJECT	Ⓗ	L	L	L	L	L	L	L	L	L	L	L	Ⓗ	L

Table 3-10 INPUT OUTPUT OF IC TC4028

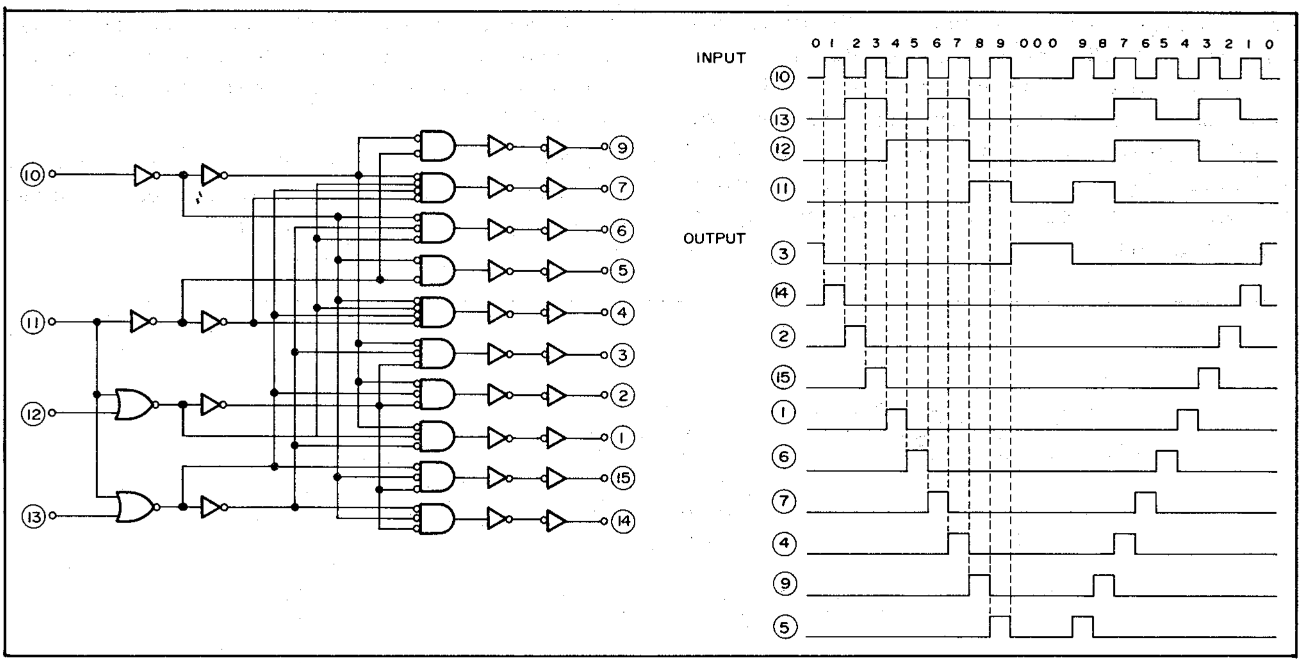

INPUT
0 1 2 3 4 5 6 7 8 9 0 0 0 9 8 7 6 5 4 3 2 1 0
OUTPUT
⑩
⑪
⑫
⑬
⑨
⑦
⑥
⑤
④
③
②
①
⑮
⑭

Fig. 3-59 BCD to decimal decoder

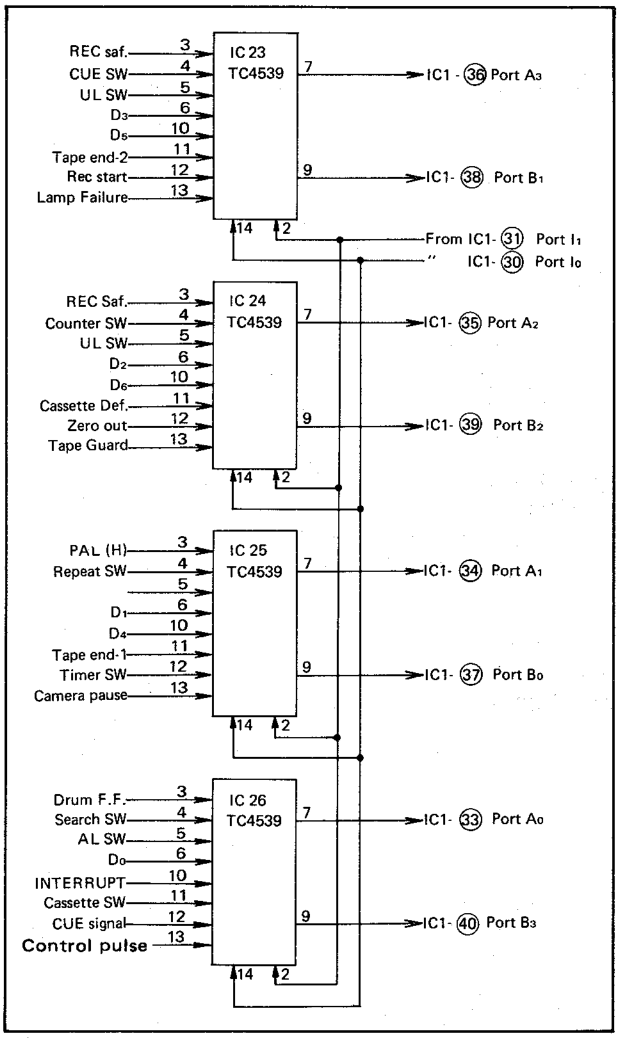

REC saf.
CUE SW
UL SW
D3
D5
Tape end-2
Rec start
Lamp Failure
IC 23
TC4539
IC1 - ㊱ Port A3
IC1- ㊳ Port B1
From IC1- ㉛ Port I1
" IC1- ㉚ Port I0
REC Saf.
Counter SW
UL SW
D2
D6
Cassette Def.
Zero out
Tape Guard
IC 24
TC4539
IC1- ㉟ Port A2
IC1- ㊴ Port B2
PAL (H)
Repeat SW
D1
D4
Tape end-1
Timer SW
Camera pause
IC 25
TC4539
IC1- ㉞ Port A1
IC1- ㊲ Port B0
Drum F.F.
Search SW
AL SW
D0
INTERRUPT
Cassette SW
CUE signal
Control pulse
IC 26
TC4539
IC1- ㉝ Port A0
IC1- ㊵ Port B3
3
4
5
6
10
11
12
13
7
9
14
2

Fig. 3-60 Data selector (TC4539 x4)

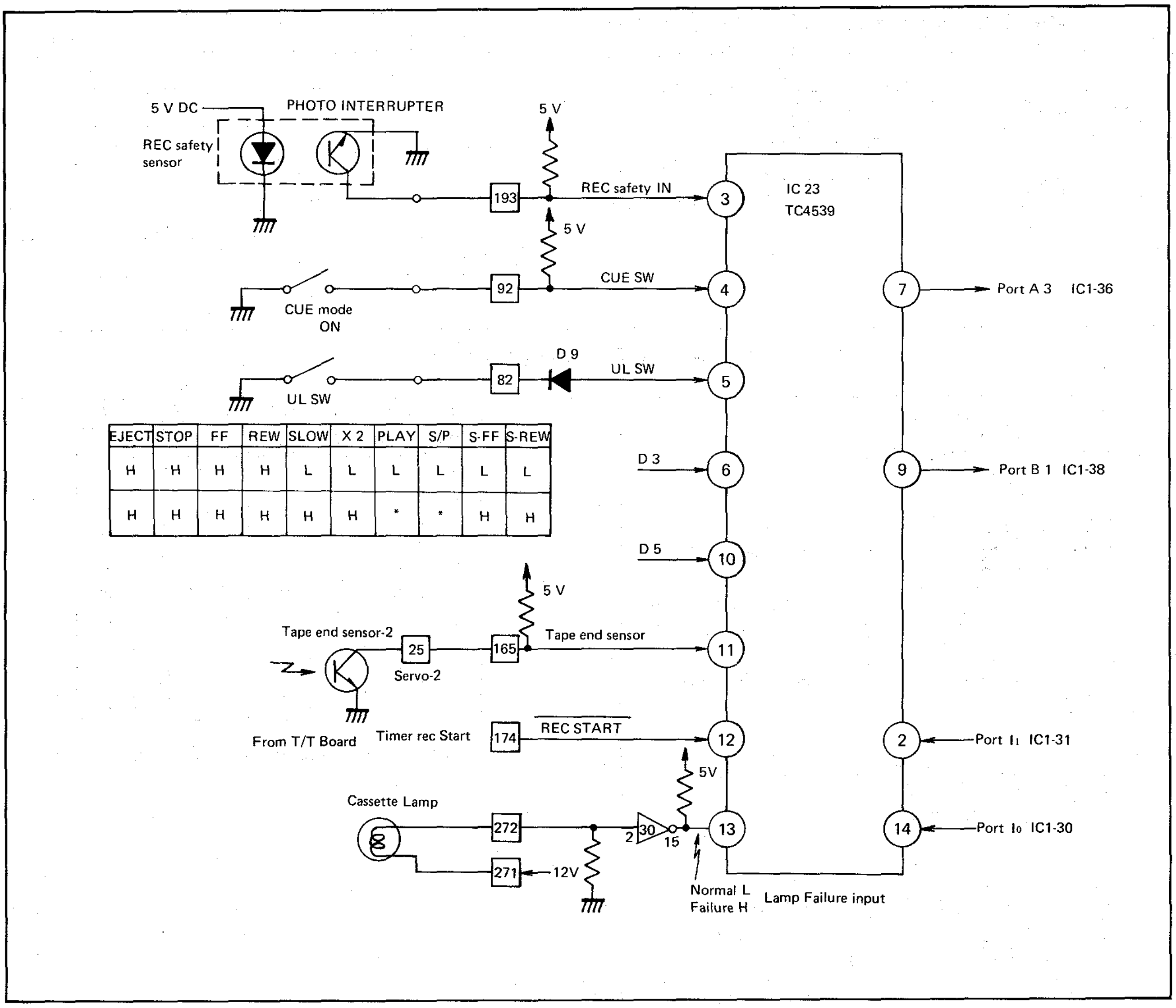
⑭ Pin	② Pin	⑥	⑤	④	③	⑦
		⑩	⑪	⑫	⑬	⑨
*	*	*	*	*	*	L
L	L	L	*	*	*	L
L	L	H	*	*	*	H
H	L	*	L	*	*	L
H	L	*	H	*	*	H
L	H	*	*	L	*	L
L	H	*	*	H	*	H
H	H	*	*	*	L	L
H	H	*	*	*	H	H

Table 3-11 Truth table of TC4539

At IC23 data selector, the states of REC safety, cue, unloading, D3, D5, tape end sensor-2, REC start signal and lamp failure are detected and outputs supplied via pins 7 and 9. These output signals go to IC1 ports A3 and B1. Signals from the I ports of IC1 at IC23 pins 2 and 14 select the output signals to pins 7 and 9. Sensor connections to the data selector are indicated in Figs. 3-61 – Fig. 3-64.

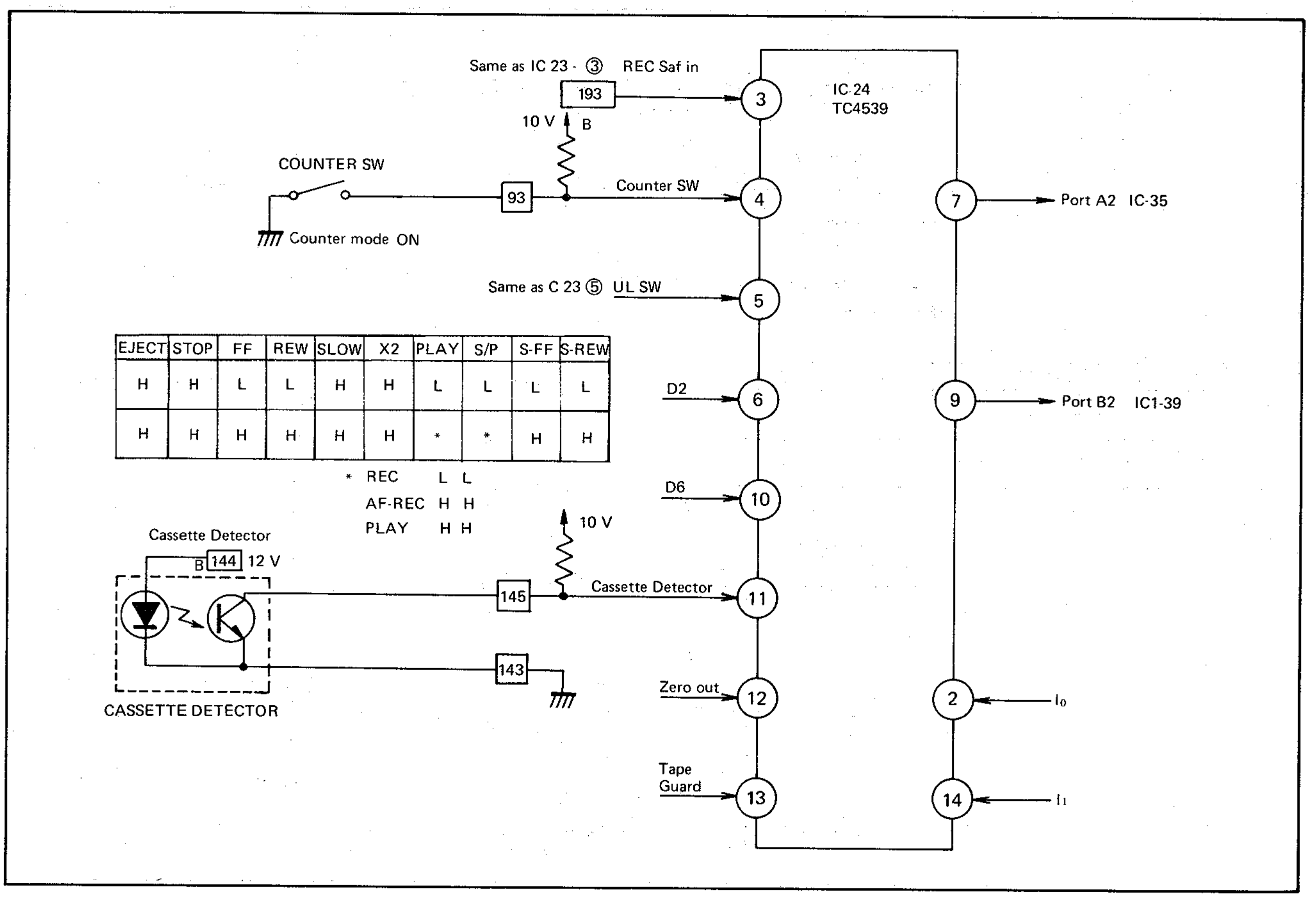
IC24 detects the states of REC safety, counter, unloading switch, D2, D6, cassette detector, zero out and tape guard. Via pins 7 and 9, these outputs go to IC1 ports A2 and B2.

IC25 monitors PAL (H), repeat, D1, D4, tape end sensor-1, timer and camera pause. The selected data from pins 7 and 9 go to IC1 ports A1 and B0.


5 V DC
PHOTO INTERRUPTER
REC safety sensor
5 V
193
REC safety IN
IC 23
TC4539
5 V
92
CUE SW
CUE mode ON
Port A 3 IC1-36
D 9
82
UL SW
UL SW
D 3
Port B 1 IC1-38
D 5
5 V
Tape end sensor-2
25
165
Tape end sensor
Servo-2
From T/T Board
Timer rec Start
174
REC START
Port I₁ IC1-31
5V
Cassette Lamp
272
271
12V
2
30
15
Normal L
Failure H
Lamp Failure input
Port I₀ IC1-30
3
4
5
6
10
11
12
13
7
9
2
14

EJECT	STOP	FF	REW	SLOW	X 2	PLAY	S/P	S-FF	S-REW
H	H	H	H	L	L	L	L	L	L
H	H	H	H	H	H	*	*	H	H

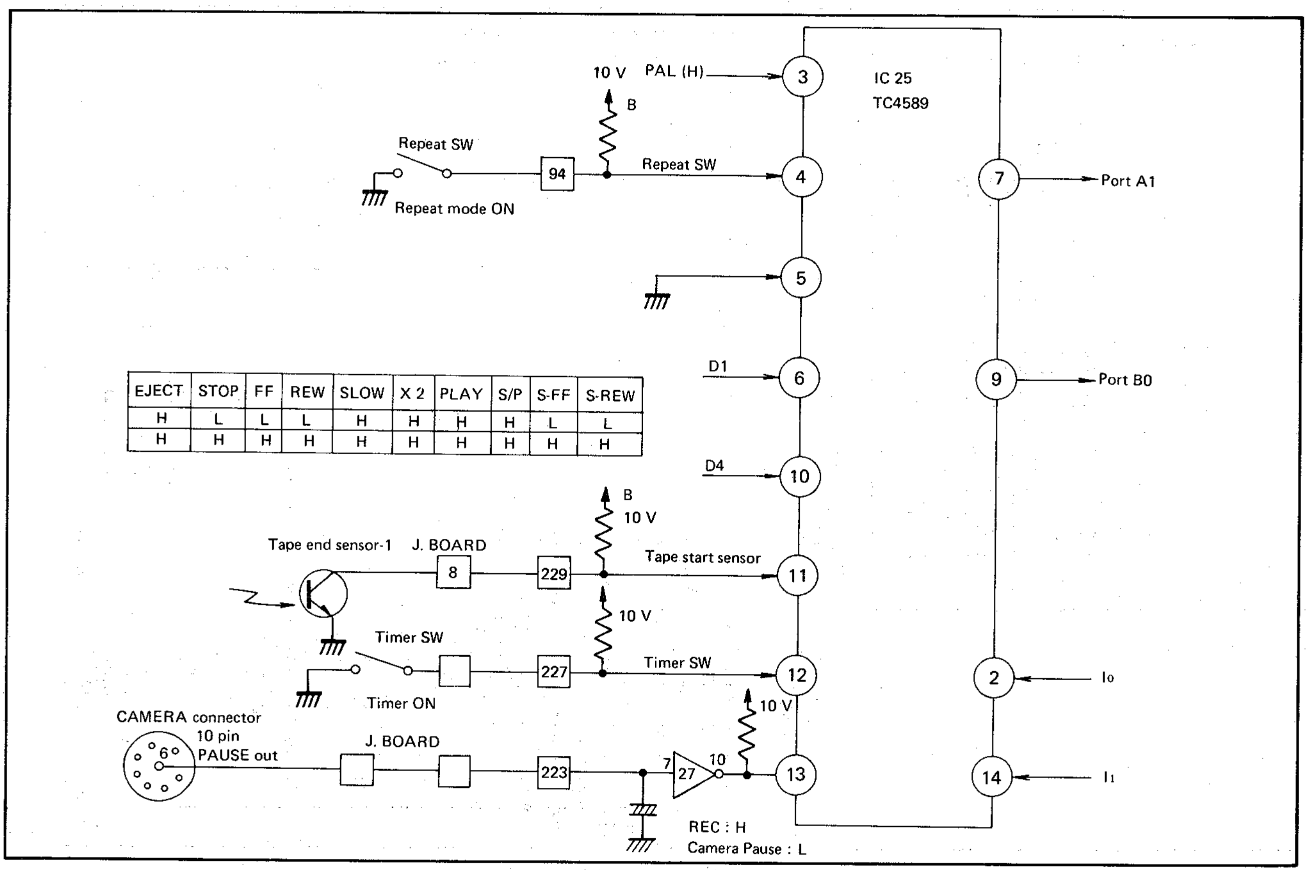
Fig. 3-61 Data selector (IC23)


Same as IC 23 - ③ REC Saf in
193
10 V
B
IC 24
TC4539
COUNTER SW
93
Counter SW
Counter mode ON
Same as C 23 ⑤ UL SW
D2
D6
10 V
Cassette Detector
B 144 12 V
145
143
CASSETTE DETECTOR
Zero out
Tape Guard
3
4
5
6
10
11
12
13
7
9
2
14
Port A2 IC-35
Port B2 IC1-39
I0
I1

EJECT	STOP	FF	REW	SLOW	X2	PLAY	S/P	S-FF	S-REW
H	H	L	L	H	H	L	L	L	L
H	H	H	H	H	H	*	*	H	H

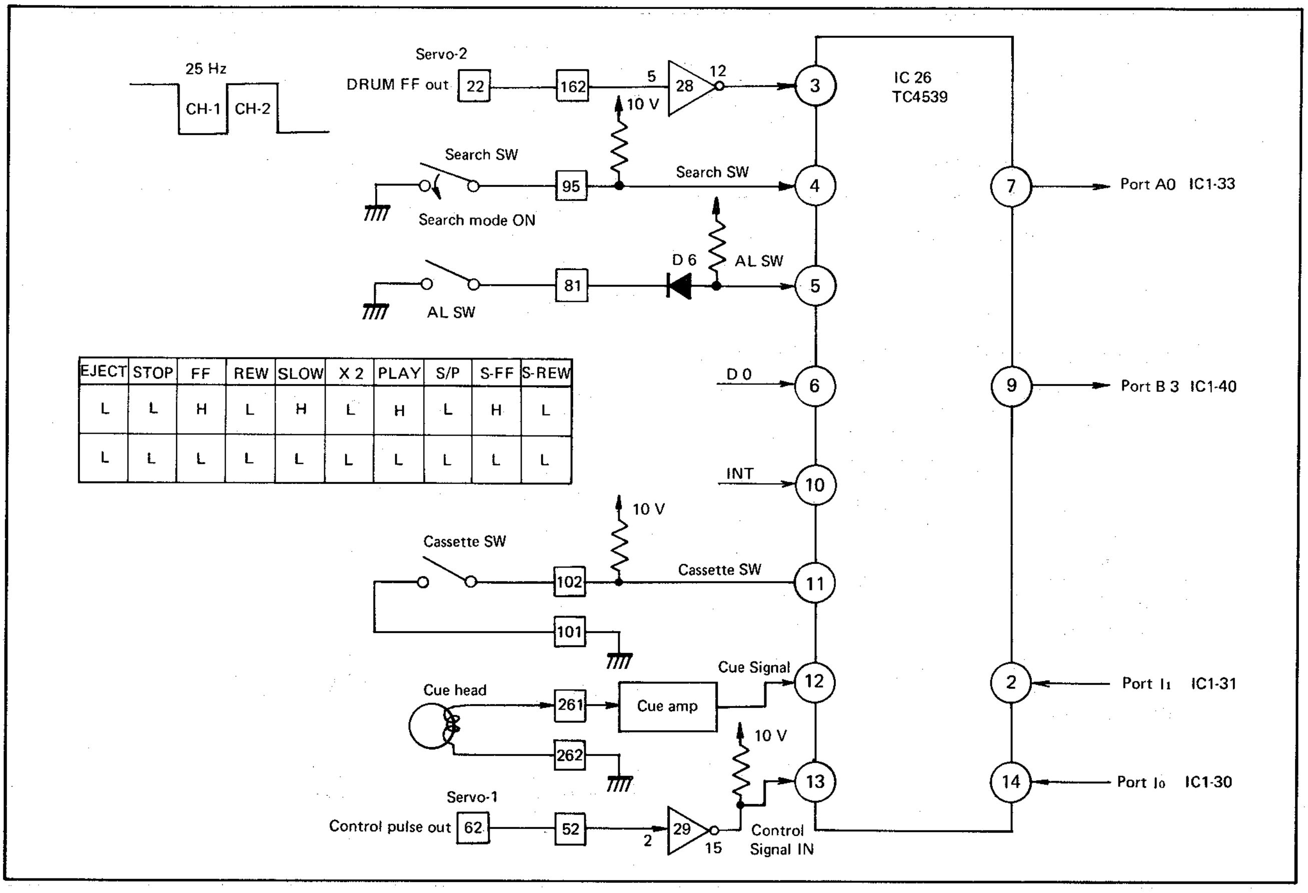
* REC L L
AF-REC H H
PLAY H H

Fig. 3-62 Data selector (IC24)


10 V PAL (H)
B
IC 25
TC4589
Repeat SW
94
Repeat SW
Repeat mode ON
D1
D4
B
10 V
Tape end sensor-1
J. BOARD
8
229
Tape start sensor
10 V
Timer SW
227
Timer SW
Timer ON
10 V
CAMERA connector
10 pin
6
PAUSE out
J. BOARD
223
7
27
10
REC : H
Camera Pause : L
3
4
5
6
10
11
12
13
7
9
2
14
Port A1
Port B0
I0
I1

EJECT	STOP	FF	REW	SLOW	X 2	PLAY	S/P	S-FF	S-REW
H	L	L	L	H	H	H	H	L	L
H	H	H	H	H	H	H	H	H	H

Fig. 3-63 Data selector (IC25)


25 Hz
CH-1
CH-2
Servo-2
DRUM FF out
22
162
5
28
12
10 V
IC 26
TC4539
3
Search SW
95
Search SW
4
Search mode ON
7
Port A0 IC1-33
D 6
AL SW
81
5
AL SW
D 0
6
9
Port B 3 IC1-40
INT
10
10 V
Cassette SW
102
Cassette SW
11
101
Cue Signal
12
Cue head
261
Cue amp
2
Port I1 IC1-31
262
10 V
13
14
Port I0 IC1-30
Servo-1
Control pulse out
62
52
29
2
15
Control
Signal IN

EJECT	STOP	FF	REW	SLOW	X 2	PLAY	S/P	S-FF	S-REW
L	L	H	L	H	L	H	L	H	L
L	L	L	L	L	L	L	L	L	L

Fig. 3-64 Data selector (IC26)

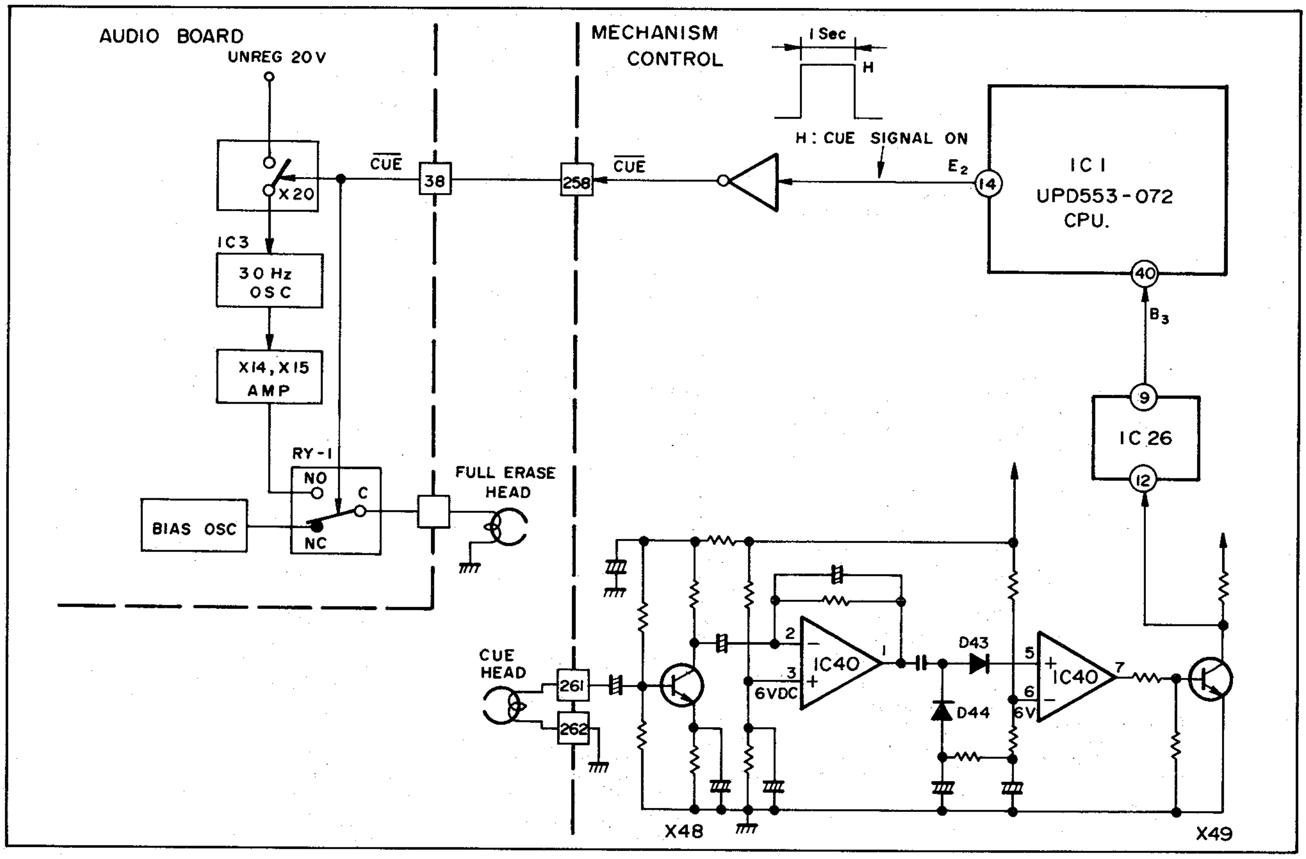

AUDIO BOARD
UNREG 20 V
CUE
38
X20
IC3
30 Hz
OSC
X14, X15
AMP
RY-1
NO
C
NC
BIAS OSC
FULL ERASE
HEAD
MECHANISM
CONTROL
1 Sec
H
H : CUE SIGNAL ON
258
CUE
E2
14
IC 1
UPD553-072
CPU.
40
B3
9
IC 26
12
CUE
HEAD
261
262
2
3
6VDC
IC40
1
D43
D44
5
6
6V
IC40
7
X48
X49

Fig. 3-65(a) Cue playback circuit

At IC26, drum FF, search, after loading, IC38 interrupt output, cassette switch, cue signal and control pulse are detected. The selected outputs go from pins 7 and 9 to IC1 ports A0 and B3.

6. Cue signal recording and playback control

1. Cue signal recording
   In the following modes, the cue signal is recorded on the tape for one second.
   1) At completion of loading after the PLAY and REC switches have been pressed simultaneously.
   2) During the Play and Still modes, when the REC and PLAY switches are pressed simultaneously.
   3) When recording starts in the Timer Record mode.
   4) After the REC and STILL/PAUSE switches are pressed simultaneously, loading is performed in the Pause mode. Pressing the PLAY switch then starts recording. The one second cue signal is recorded at this time.

   The cue signal is recorded in the above cases regardless of the SEARCH and REPEAT switch settings. In these cases, a 1 second high pulse from IC1 pin 14 port E2 is inverted and sent as $\overline{\text{cue}}$ out to the audio circuit. Via audio board terminal 38, the $\overline{\text{cue}}$ signal goes to switch X20 and relay RY-1. For one second, RY-1 switches to the NO position and supplies a 30 Hz signal to the full erase head.

   During the $\overline{\text{cue}}$ period, switch X20 supplies unregulated 20 V to IC3 30 Hz oscillator. The 30 Hz is amplified by X14 and X15, then applied to the full erase head. In this manner, the output of mechacon IC1 port E2 controls cue signal recording without regard to the positions of the front panel REPEAT and SEARCH switches.

2. Cue signal playback
   The cue signal is played back by the cue head during REW and FF, while tape remains in the cassette. Although the tape also contacts the cue head during the Play mode, the cue signal cannot be played back due to the slow tape speed. The cue playback circuit functions regardless of the SEARCH and REPEAT switch settings. Cue stop control is performed by the CPU.

   Upon playback, the cue signal is amplified to approx. 3.5 ± 1.5 V DC at X48. Approximately 6 V DC is applied to IC40 pin 3. The cue signal from X48 collector appears at IC40 pin 2 and the amplified output is obtained from pin 1.

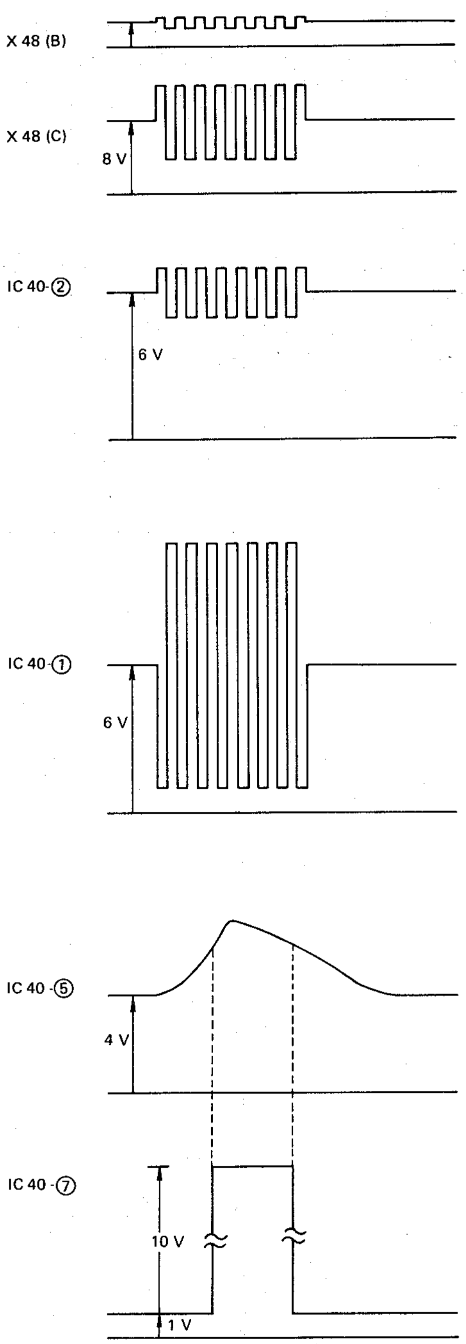


Fig. 3-65(b) Timining chart

D43 and D44 rectify the signal from IC40 pin 1 and apply it to IC40 pin 5. Since approx. 6 V DC is applied to IC40 pin 6, then the pin 5 rectified output exceeds the pin 6 voltage, an approx. 10 V pulse appears at pin 7. This pulse switches X49 on and low voltage goes to IC26 pin 26 (data selector cue signal input). The cue signal is selected by IC26 and applied to CPU IC1 port B2 (pin 40).

7. Solenoid drive circuits

1. Brake solenoid
   The outputs of IC1 pins 16 and 17 (ports F0 and F1) drive the brake solenoid. An approx. 140 msec high pulse from F0 is used for initial operation of the solenoid. This output is inverted by IC32 and operates switch X3. Plus 20 V at the low resistance terminal 123 of the solenoid provides a large current flow and produces a strong initial pulling force.

   At the same time, F1 output rise at IC32 switches X4 on. This applies +20 V to terminal 122, which becomes the solenoid holding voltage.

   The brake solenoid operates in the following modes (also see flowcharts for each mode).

   Play, REC, REW, FF, Unloading, Loading, Search REW and Search FF

2. Pinch roller solenoid
   Outputs of ports F2 and F3 at IC1 pins 18 and 19 operate the pinch roller solenoid. The F2 output from pin 18 becomes an approx. 140 msec high pulse which initially drives the solenoid. Solenoid holding output is from port F3. Circuit operation is the same as that of the brake solenoid.

   The pinch roller solenoid is operated according to the Play and Record modes.

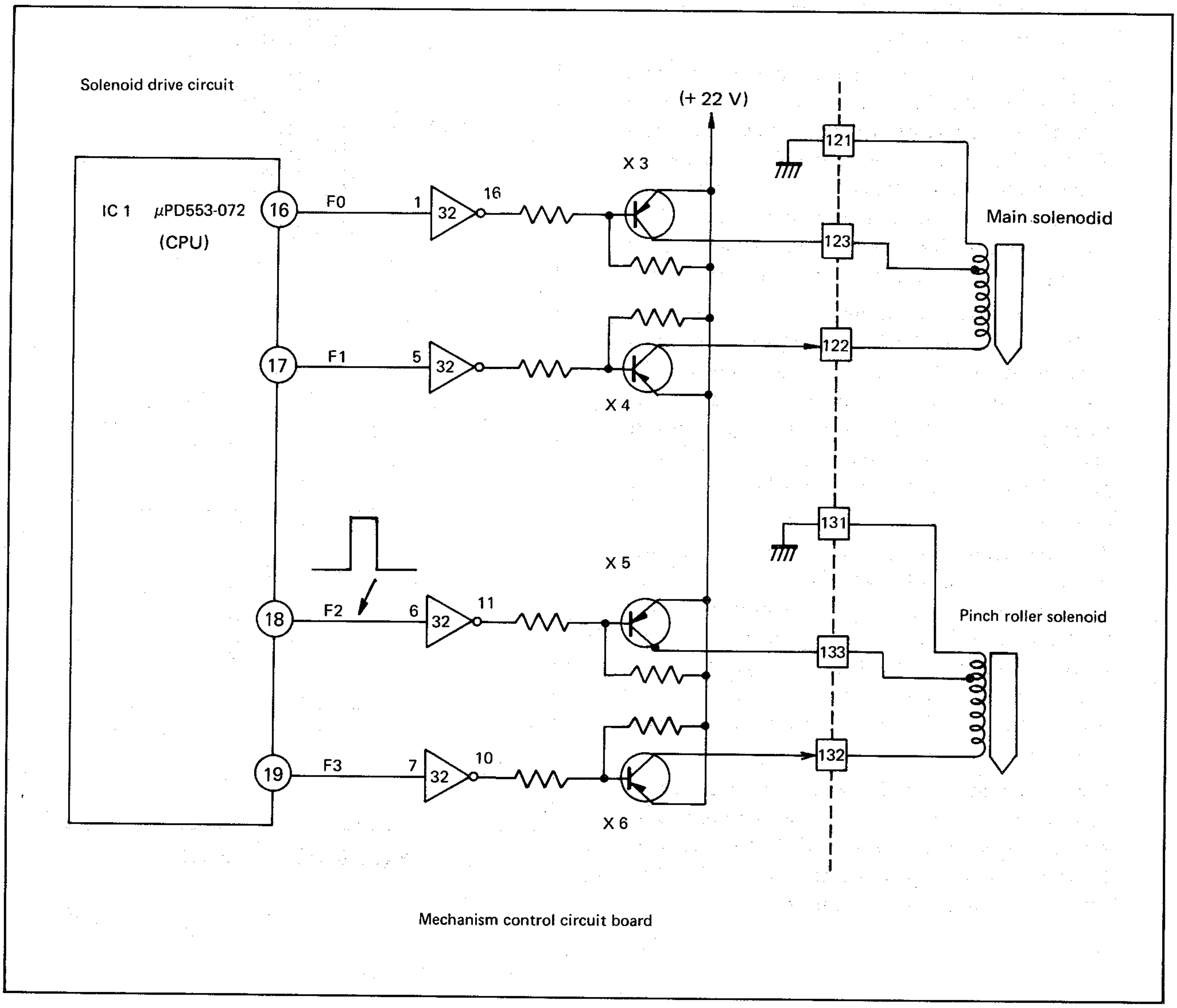

Solenoid drive circuit
(+ 22 V)
IC 1 μPD553-072 (CPU)
16
17
18
19
F0
F1
F2
F3
1
5
6
7
32
16
11
10
X 3
X 4
X 5
X 6
121
123
122
131
133
132
Main solenodid
Pinch roller solenoid
Mechanism control circuit board

Fig. 3-66 Solenoid drive control

8. Motor drive and control circuits

1. Cassette motor drive

Cassette motor rotation is controlled from IC1 ports G2, G3 and H0. The port outputs are as follows.

Port H0 IC1 pin 26	High during Eject
Port G2 IC1 pin 24	High during cassette loading
Port G3 IC1 pin 25	High during cassette loading

Via switching transistors, the above outputs control the rotation of the cassette motor in the eject and loading directions.

2. Loading motor drive

This circuit controls the loading motor rotation according to the outputs of ports G0 and G1 of IC1 CPU. These outputs are indicated below.

Port G0 IC1 pin 22	High during normal (Stop); low only during unloading
Port G1 IC1 pin 23	High during normal (Stop); low only during loading

Pins 22 and 23 are high during normal modes (i.e., other than loading and unloading), at which time X7 is cut off through NAND gate IC8, stopping power supply to the motor. When IC1 pin 22 is low (during unloading), IC8 NAND gate output goes high, switching X7 on and supplying 12 V to the loading motor circuit.

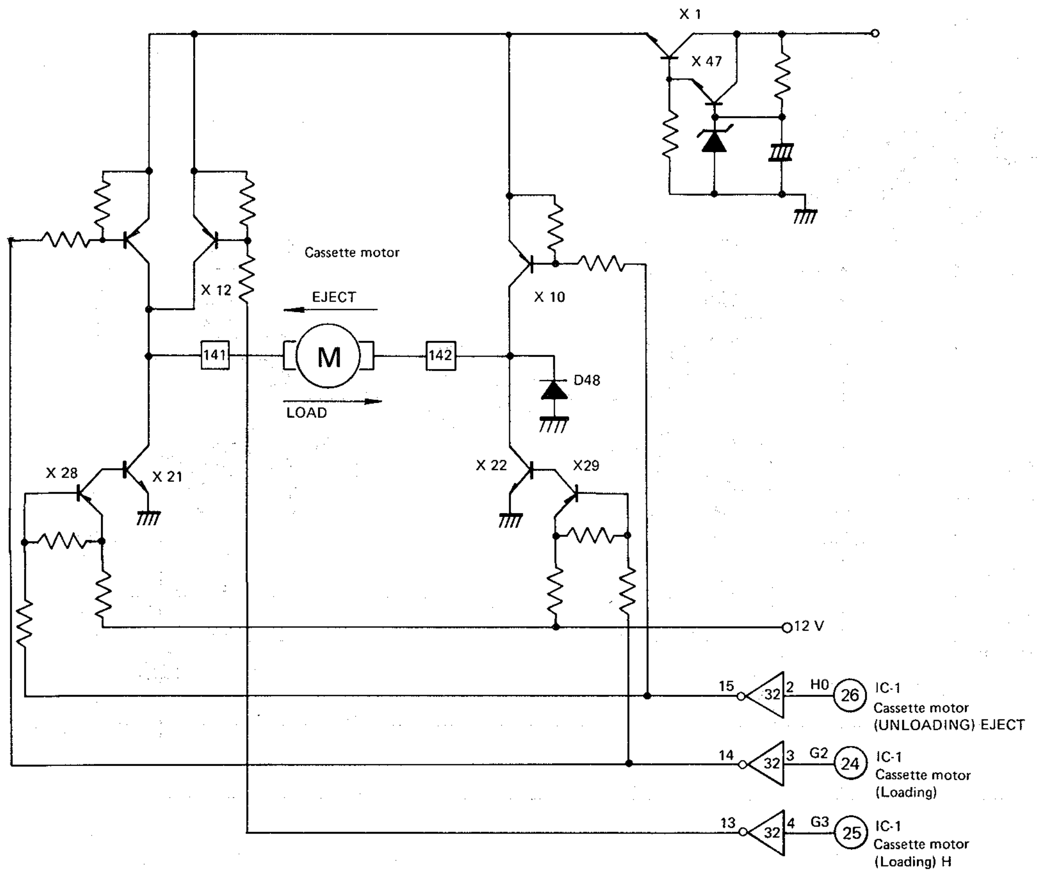

X 1
X 47
Cassette motor
X 12
EJECT
141
M
142
LOAD
X 10
D48
X 28
X 21
X 22
X29
12 V
15
32
2
H0
26
IC-1
Cassette motor
(UNLOADING) EJECT
14
32
3
G2
24
IC-1
Cassette motor
(Loading)
13
32
4
G3
25
IC-1
Cassette motor
(Loading) H

Fig. 3-67 Cassette motor Control

Since IC1 pin 23 remains high, low through inverter X27 is applied to X9 base. This switches X9, X27 and X20 on and the loading motor starts rotating in the unloading direction.

For the loading direction, IC1 pin 23 goes low.

3. Reel motor control

Reel motor rotation in each mode is controlled by this circuit. A 4 bit signal from IC1 port D controls the motor circuit on/off switch.

1) Direction

The outputs of IC16 pin 10 and IC8 pin 3 determine the rotating direction of the reel motor. High from IC16 pin 10 is inverted by IC34, switching on X36, X25, X39 and X18. D0 output is low at this time and the reel motor rotates in reverse for Idler (−), REW, Unloading or S-REW modes.

High from IC8 pin 3, through inverter IC39, switches on X34, X23, X24 and X35. The reel motor then rotates in the forward direction. Conditions required for high at IC8 pin 3 are:

a) D0 output high, i.e., Play, FF, S-FF and Idler (+) modes when reel motor rotation is forward.

b) D1, D2 and D3 outputs low, i.e., during Play.

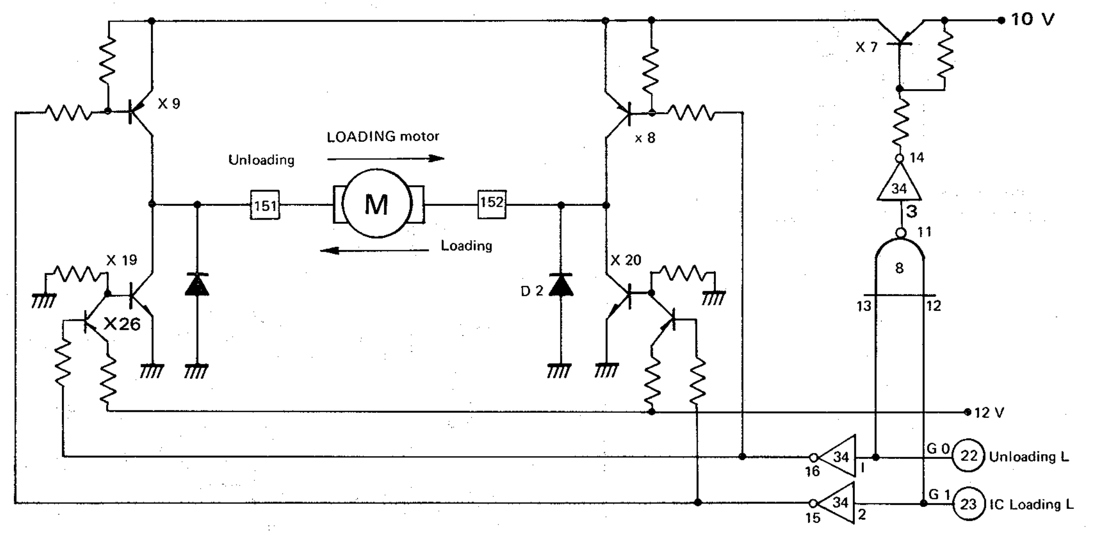
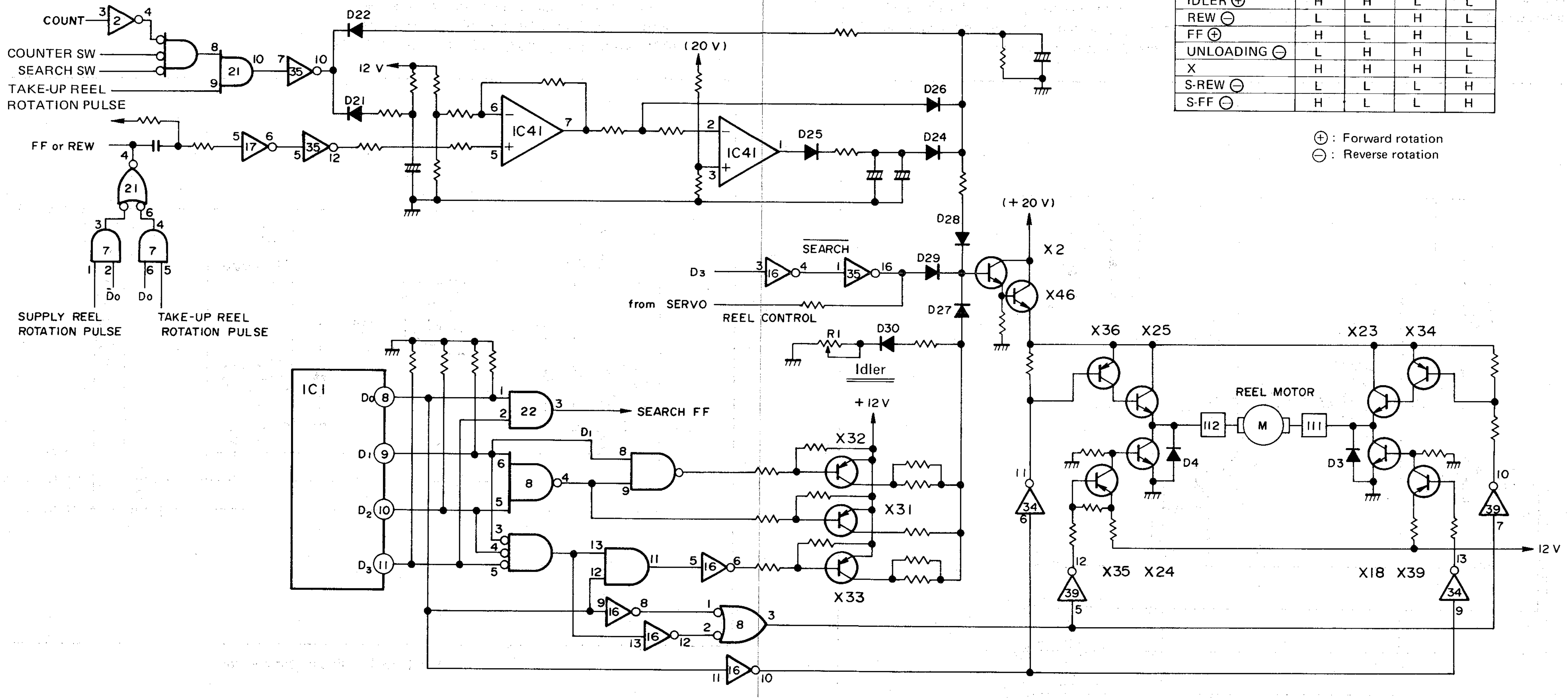

10 V
X 7
X 9
x 8
LOADING motor
Unloading
Loading
151
M
152
14
34
3
11
8
13
12
X 19
X26
D 2
X 20
12 V
G 0
22
Unloading L
16
34
1
G 1
23
IC Loading L
15
34
2

Fig. 3-68 Loading motor control

Output of IC1 D port

Mode \ Port	D_0	D_1	D_2	D_3
OFF	L	L	L	L
PLAY ⊕	H	L	L	L
IDLER ⊖	L	H	L	L
IDLER ⊕	H	H	L	L
REW ⊖	L	L	H	L
FF ⊕	H	L	H	L
UNLOADING ⊖	L	H	H	L
X	H	H	H	L
S-REW ⊖	L	L	L	H
S-FF ⊖	H	L	L	H

⊕ : Forward rotation
⊖ : Reverse rotation



COUNT
COUNTER SW
SEARCH SW
TAKE-UP REEL ROTATION PULSE
FF or REW
SUPPLY REEL ROTATION PULSE
TAKE-UP REEL ROTATION PULSE
D22
D21
12 V
IC41
IC41
(20 V)
D26
D25
D24
D28
(+ 20 V)
X2
X46
D3
SEARCH
D29
D27
from SERVO
REEL CONTROL
R1
D30
Idler
IC1
D0
D1
D2
D3
SEARCH FF
+12 V
X32
X31
X33
X36
X25
X23
X34
REEL MOTOR
M
112
111
D4
D3
X35
X24
X18
X39
12 V

Fig. 3-69

2) Speed

By varying X2 base bias, the reel motor speed is controlled in the following modes.

a) Idler (during idler rotation)
b) Unloading
c) Play (including Still, Slow, X2 and REC)
d) Search REW and Search FF
e) REW and FF (other than counter search)
f) REW and FF (counter search mode)

Voltage applied to X2 base via X31, X32, X33 and X27 controls the reel motor speed during Idler, Unloading and Play modes. In these modes, low voltage switches on transistors X31, X32 and X33. This potential goes through D27 to X2 base. D30 and R1 provide speed adjustment during these modes.

In the Search mode, motor speed is controlled by voltage through D29. High output from D3 is inverted and IC35 pin 16 goes high. Reel motor control voltage from the servo circuit then goes through D29 to X2 base. This provides about 10 times normal tape speed.

Voltage to X2 base is applied via D28 in the REW and FF modes. During normal Rewind, the signal to IC21 pin 4 is obtained from IC7 pins 1 and 2 or IC7 pins 5 and 6. This is compared with the take-up reel rotation pulse during REW (and with the supply reel rotation pulse during FF). The result is differentiated and sent to IC41 pin 5. IC41 pins 5, 6 and 7 function as a DC amplifier.

9. Tape counter

IC13 (TC4029P) is a presettable up/down counter. It is a 4 bit decade or binary counter with preset, up-count, down-count and carry functions.

Up/down inputs control decade count and down-count. In this model, IC13 pin 9 is held at high level and operation is performed as a base 16 up/down counter. High at pin 10 provides count-up and low yields count-down. The preset input is low during normal and goes high when the preset switch is pressed. A high input stops the counting operation and count starts when the preset input drops low. Counting is performed at the rising portion of the clock pulse.

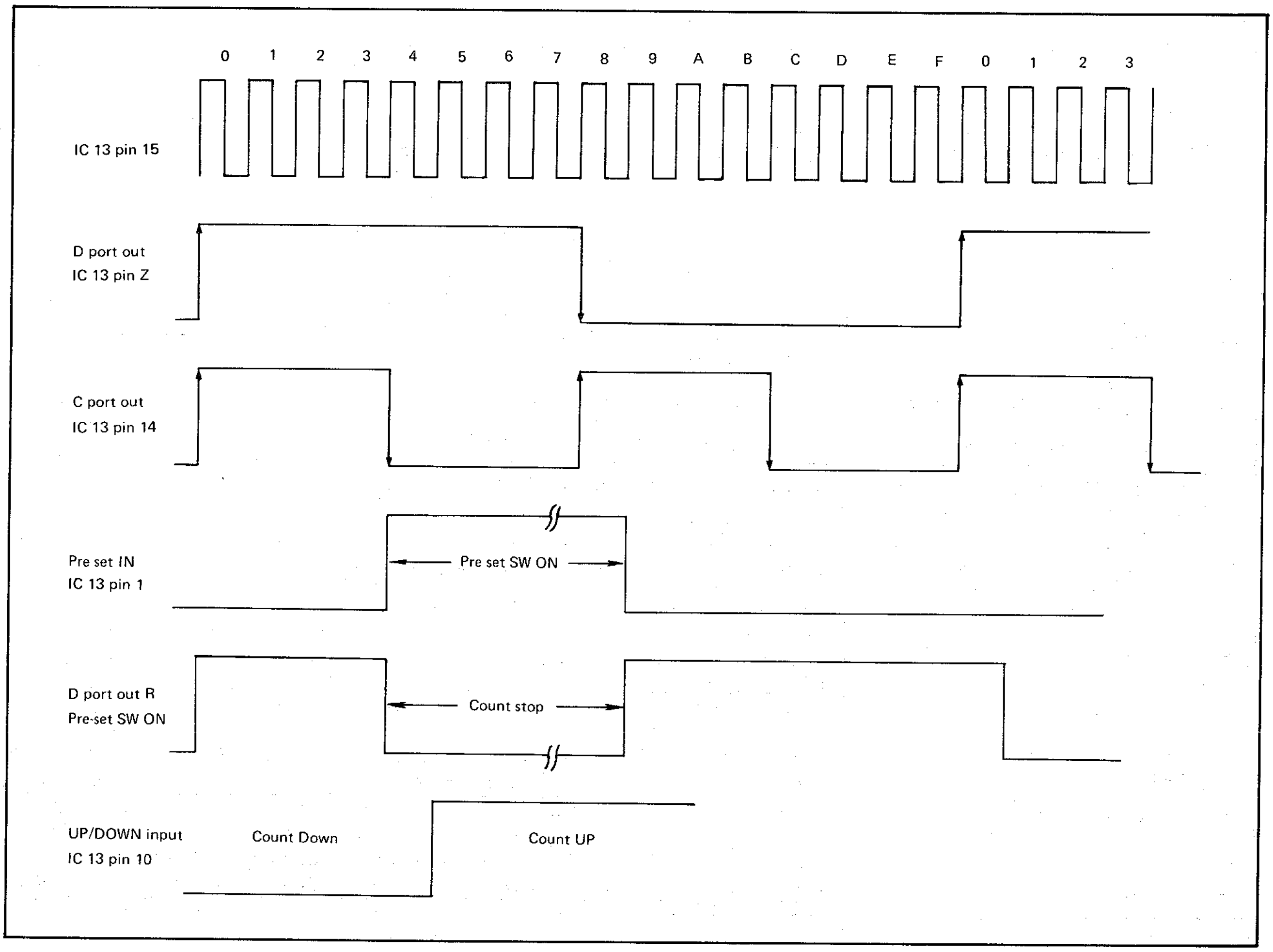


Fig. 3-70

10. IC1 (CPU) Input/Output Signal Table

PIN No.	Name	Input/Output Signal	Function
1	CLOCK	Clock OSC.	Clock OSC. LC input (Clock 400 kHz)
2	Port C_0	Function LED control out	4-bit Function LED control output
3	C_1	〃	
4	C_2	〃	
5	C_3	〃	

	OFF	STOP	SLOW	SPEED	FF	REW	REC	AF-REC	EJECT
C_0	L	H	L	H	L	H	L	H	L
C_1	L	L	H	H	L	L	H	H	L
C_2	L	L	L	L	H	H	H	H	L
C_3	L	L	L	L	L	L	L	L	H

PIN No.	Name	Input/Output Signal	Function
6	INT	Interrupt input	Interrupt with low signal
7	Reset	Reset input	Reset with low signal
8	Port D_0	Reel motor control out	4-bit Reel motor rotation speed control signal output — : Forward rotation + : Reverse rotation
9	D_1	〃	
10	D_2	〃	
11	D_3	〃	

	OFF	PLAY +	IDLER −	IDLER +	REW −	FF +	UNLOAD −	S-REW −	S-FF +
D_0	L	H	L	H	L	H	L	L	H
D_1	L	L	H	H	L	L	H	L	L
D_2	L	L	L	L	H	H	H	L	L
D_3	L	L	L	L	L	L	L	H	H

PIN No.	Name	Input/Output Signal	Function
12	Port E_0	Count UP/DOWN control	Tape counter UP/DOWN control output. H: Count up L: Count down
13	E_1	REC/STOP 12 V control	L: REC/STOP 12 ON, H: REC/STOP 12 V OFF
14	E_2	Cue REC control	Cue signal recording control output. H: Cue signal REC ON L: Cue REC OFF
15	E_3	Lamp Flag out	LED Flag control signal. H: Lamp Flag ON
16	Port F_0	Main sol. control	Main solenoid control output H: OFF L: ON
17	F_1	〃	〃 H: OFF L: ON
18	F_2	Pinch roller sol. control	Pinch solenoid control output
19	F_3	〃	〃
20	TEST	Test input	
21	Vss		
22	Port G_0	Loading motor control	Loading motor control out. H: Unloading
23	G_1	〃	〃 H: Loading
24	G_2	Cassette motor control	Cassette motor control out. H: Cassette Load
25	G_3	〃	〃 H: 〃
26	Port H_0	〃	〃 H: EJECT
27	H_1	REC out	REC mode : H
28	H_2	STILL/PAUSE Lamp out	Still/Pause Lamp control out. H: ON L: OFF
29	H_3	PLAY Lamp out	Play Lamp control out H: ON L: OFF
30	Port I_0	Data selector control out	Data select control output for IC23, 24, 25, 26.
31	I_1	〃	〃
32	I_2	Warning control out	Warning Lamp control out. Warning mode : H
33	Port A_0	Data inputs	Data input from Data selector IC23, 24, 25, 26.
34	A_1	〃	
35	A_2	〃	
36	A_3	〃	
37	Port B_0	〃	
38	B_1	〃	
39	B_2	〃	
40	B_3	〃	

I_{out} / A·B input	I_0 L I_1 L	I_0 H I_1 L	I_0 L I_1 H	I_0 H I_1 H
A_0	mode SW input D_0	After Loading SW (L)	Search SW (L)	Drum F.F.
A_1	〃 D_1	—	Repeat SW (L)	PAL (H)
A_2	〃 D_2	Unloading SW (L)	Counter SW (L)	REC Safety SW (H)
A_3	〃 D_3	Unloading SW (L)	Cue SW (L)	REC OFF
B_0	〃 D_4	Tape start sensor (L)	Timer SW (L)	Camera Pause
B_1	〃 D_5	Tape end sensor (L)	Timer signal (L)	Lamp Failure
B_2	〃 D_6	Cassette Detector (H)	Counter signal (L)	Tape Guard
B_3	SW select (L)	Cassette SW (L)	Cue signal (L)	Control signal in

PIN No.	Name	Input/Output Signal	Function
41	GND	—	—
42	CLOCK	Clock Osc.	400 kHz Osc.

Table 3-12

3.3 TUNER AND TIMER CONTROL SYSTEMS

3.3.1 Computerized station selection

Recent model color television receivers have replaced the earlier rotary switch type channel selector knobs with electronic tuning systems. These systems employ LSI devices and allow direct, light-touch channel selection, plus remote controlled selection with premium grade sets.

This model VHS recorder advances the electronic tuning concept by incorporating microcomputer controlled memory and programming functions. Among the main operating conveniences offered are:

1) Light-touch channel selection
2) Automatic channel selection and memory
3) Manual channel selection
4) Push button fine tuning
5) Remote control compatibility
6) Selection of programs in advance

Light-touch channel selection allows a desired TV channel to be selected directly by pressing a button. In contrast to rotary switch type selectors, there is no need to switch past undesired channels before arriving at the desired one. Channels can also be selected by using the buttons of the remote control unit.

The automatic channel selection feature offers convenience when the machine is used in a location where the active TV channels are unknown. By setting the front panel PROG SEARCH switch to AUTO and pressing the appropriate BAND button, the channels are automatically polled in sequence and the first channel containing a broadcast signal becomes selected.

Previous types of one-touch electronic tuners used variable capacitance diodes (varicaps), variable resistors (preset controls) for setting the tuning voltage, plus separate digital ICs for each channel. Thus, the system

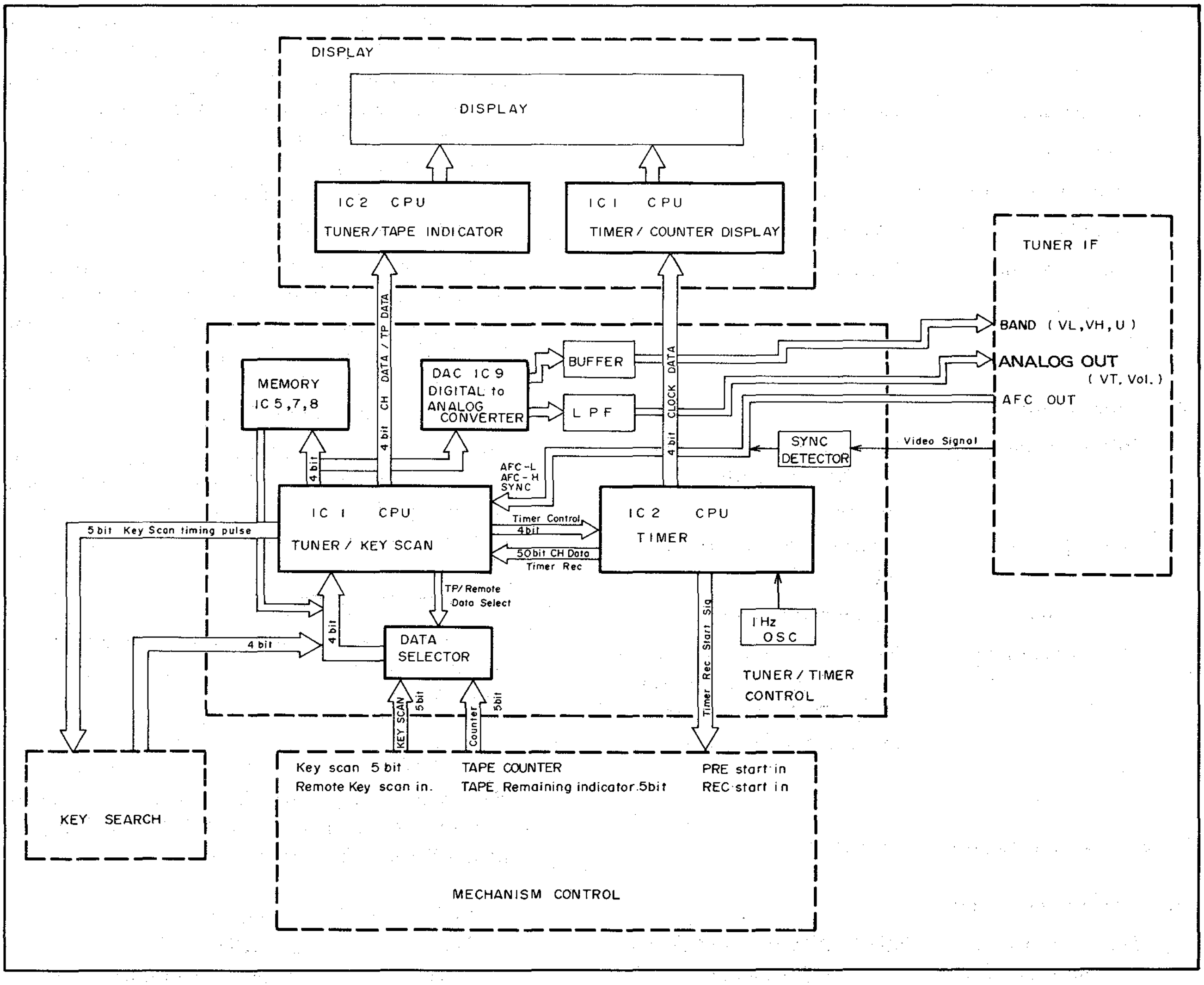

DISPLAY
DISPLAY
IC 2 CPU
TUNER/TAPE INDICATOR
IC I CPU
TIMER/ COUNTER DISPLAY
TUNER IF
BAND (VL,VH,U)
ANALOG OUT
(VT. Vol.)
AFC OUT
Video Signal
4 bit CH DATA / TP DATA
4 bit CLOCK DATA
MEMORY
IC 5,7,8
DAC IC 9
DIGITAL to
ANALOG
CONVERTER
BUFFER
L P F
SYNC
DETECTOR
4 bit
AFC-L
AFC-H
SYNC
IC I CPU
TUNER / KEY SCAN
Timer Control
4bit
50bit CH Data
Timer Rec
IC 2 CPU
TIMER
5 bit Key Scan timing pulse
TP/ Remote
Data Select
4 bit
4 bit
DATA
SELECTOR
Timer Rec Start Sig
1 Hz
OSC
TUNER / TIMER
CONTROL
KEY SCAN
5bit
Counter
5bit
KEY SEARCH
Key scan 5 bit
Remote Key scan in.
TAPE COUNTER
TAPE Remaining indicator 5bit
PRE start in
REC start in
MECHANISM CONTROL

Fig. 3-71 Timer Tuner Block diagram

possessed disadvantages in terms of complexity and space requirements.

The microcomputerized fully electronic tuner system eliminates the need for a bank of preset controls and instead stores a digitized tuning voltage for each channel in a memory. When retrieved from the memory, the digital signal is converted to a DC voltage and applied to the electronic tuner. Thus, a one-chip microcomputer and a non-volatile memory perform channel selection, receiving control and data storage.

3.3.2 Tuner/Timer functions

1. Tuner IF section

Broadcast Standard	: CCIR- PAL BG system
Receiving Channels	: VHF: 2 to 12, UHF; 21 to 69
Video IF	: 38.9 MHz
Audio IF	: 33.4 MHz
Channels	: Maximum 32
Selecting System	: Auto tuning
Channel Memory	: Maximum 32 channels
Antenna Input	: 75 Ω unbalanced
Video Signal Output	: 1.0 Vp-p
Audio Signal Output	: 0.44 V (−14 dBs)
UHF/VHF Tuner	: Wideband tuner
RF Converter	
Antenna Booster	

2. Timer section

Programmable Timer	: 8 Programs, up to 2 weeks in advance; with repeat function
Timer Backup	: Nickel-cadmium battery (approx. 1 hour)
Clock Function	: Crystal controlled
Timer Recording	: Pre-start output produced 10 seconds prior to set time; REC start output begins actual recording

3.3.3 Tuner/Timer operation checks

1. Power interruption

Set the rear panel MAINS POWER switch to OFF, wait at least one hour, then set the switch to ON. At this time, the timer indication should read 88 hours, 88 minutes, 00 seconds, which flash at a one second interval.

Also: Tuner indicators extinguished
Program mode setting inhibited
Tape counter reset
Dimmer released

2. Front power on

Press the front panel ON button. At this time:
On indicator lights
TV PROGRAM NO. display lights

3. Clock set

Press the CLOCK SET button. The display becomes 0 hours, 00 minutes, 00 seconds and seconds count begins. Only the seconds indication flashes.

4. Timer set

While the seconds display flashes, pressing the SET button resets the indication to 00. The seconds count does not advance while the button is held depressed. Press the SELECT button and the minutes indicators flash, then press the SET button to advance the minutes display by 1 minute. Hold the SET button depressed for fast advance at approx. 8 Hz. Note that the hours display does not increment at the transition from 59 minutes to 00 minutes.

At this point, again press the SELECT button; the hours indication flashes. Press the SET button to stop the flashing and advance the hours. Hold the SET button depressed for fast advance. Note that the days display does not increment at the transition from 23 hours to 0 hours.

Press the SELECT button a third time and the SUN (Sunday) indication flashes. Press the SET button to advance the days; hold the button depressed for fast advance.

5. Automatic clock reset

If no entry is made during the CLOCK SET mode, the clock mode is automatically returned after about 70 seconds.

6. Program set

By pressing the PROG SET button, the program display lights and only the TV PROGRAM indication flashes. The display reads:

Program No.	1
TV Program	1 (flashes)
Day	1st SUN
Time	0 hours 00 minutes
REC Length	000 minutes

7. Program timer setting

In the program set state, pressing the SET button advanced the TV Program No. Holding the button depressed provides fast advance.

EG Model: Channel 1 to channel 32
S/EK Model: Channel 1 to channel 16

Next, when the SELECT button is pressed, 1st SUN flashes. The day indication shifts each time the button is pressed; holding the button depressed provides fast advance.

Recording length setting is performed in the same manner as timer set. The three recording length digits flash. Pressing the SET button advances the indication in 5 minute increments; holding the button depressed provides fast advance. Setting range is from 000 to 395 minutes.

8. REPEAT button

Press the REPEAT button and the repeat indicator lights. The set program becomes repeated (same day, same time, following week).

9. PROGRAM NO. button

When set to ON, the program number can be changed.

10. CANCEL button

This resets the indicated program memory, after which the program set mode is returned.

11. All cancel operation

Simultaneously press the PROG NO and CANCEL buttons to reset the memories of programs 1 through 8. This operation cannot be performed with the remote control unit.

12. Automatic return

If the program set mode continues for more than 70 seconds without an entry being made, the clock mode becomes returned.

13. Program invalidate

If the recording length is not entered, the program becomes invalidated.

14. Program priority

When two programs are set at the same time, the lower numbered program is performed. If programs overlap, the most recently entered program is implemented.

15. Timer operations

Press the TIMER button and the timer indicator lights. The ON indicator and tuner section indicators extinguish. Ten seconds before the scheduled recording time, the prestart output is produced. The ON and tuner indicators light and the specified TV program channel is set. The CH LOCK indicator lights and loading is performed. At the completion of loading, the Pause mode is entered.

Then at the recording set time, the Pause mode is released and recording begins.

16. Program correction during timer recording

During timer recording, pressing the PROG SET button changes the program display. While timer recording is in progress, only the recording length can be corrected. If the corrected recording time is greater than the elapsed time, recording continues to the newly set time. When the corrected recording time is equal or less than the elapsed time, recording becomes relased within one minute.

With regard to programs other than one actually in progress, the setting is the same as for normal program setting.

17. Completion of timer recording

Prestart and REC start outputs cease simultaneously. In other than Repeat mode, the program memory is erased within 1 second.

18. Succeeding or overlapped program

In the case of an immediately succeeding or overlapped program, the prestart operation is not performed.

19. Clock increment

In the Clock mode, the clock increments as an ordinary 24 hour digital clock, e.g., SAT 23 hours, 59 minutes, 59 seconds increments to SUN, 0 hours, 0 minutes, 00 seconds.

Tuner Control Checks

1. Manual channel setting

Press the CH SET button and the CH SET and tuning indicators light. Then set the PROG SEARCH switch to MANU and press the BAND button according to the desired band. Hold the button depressed and the tuning indicator shifts. Fine tuning is performed by pressing the FINE TUNING (+ & –) buttons.

2. Automatic channel setting

   Set the PROG SEARCH switch to AUTO and select the band with the BAND buttons. The tuning indicator shifts automatically. When sync is detected, the sweep speed decreases and fine tuning is performed.

3. STORE button

   Pressing the STORE button stores the channel data in the non-volatile memory.

4. TV PROGRAM buttons

   Pressing these buttons changes the TV program no. When a button is held depressed, the change becomes continuous at 1 Hz.

5. Skip set

   Set the PROG SEARCH switch to MANU and simultaneously press the desired BAND and STORE buttons. The indicated TV program becomes skipped (however, program no. 1 is not skipped). Skip setting is enabled only in the CH SET mode and skip operation is performed only during TV program. Skip can be released by again performing CH SET.

6. TV program shift in CH SET mode

   Operating the TV PROGRAM (+ & –) buttons in the CH SET mode changes the TV program no. Holding one of the buttons depressed for more than 1 second provides continuous change at 1 Hz. Skip operation is not performed at this time.

7. TV program shift

   The program no. is changed by operating the TV PROGRAM (+ & –) buttons. Holding a button depressed for more than 1 second provides continuous change at 1 Hz. If skip has been set, the affected programs are skipped.

8. Channel lock

   The LOCK indicator lights when the CH LOCK button is depressed to the locked position. At this time, pressing the TV PROGRAM buttons will not change the program no.

9. Program memory check

   Operating the front panel power buttons ON-OFF-ON does not change the TV program no. or the program memory contents.

10. Audio muting

    Audio muting functions in absence of a signal and when changing TV programs.

Tape Counter Operations

Pressing the COUNTER button produces the counter indication. The displayed numerals are synchronized to the count pulse. Count-up is performed in the forward direction and count-down in the reverse direction. Pressing the RESET button resets the counter indication to 0000.

3.3.4 Microcomputerized channel selection

Refer to the tuner/timer control system block diagram. The central processing unit is comprised of IC1 (μPD546C-166) and IC2 (μPD650C-049). The μcom consists of a 2000 word program area (8 bits per word mask ROM) and a 96 word (4 bits per word RAM) data area. Included in the 42 pin LSI package are 4 bit parallel input ports A and B, input/output ports C and D, and output ports E, F, G, H, and I (I is 3 bits). Software control of these input and output lines provides overall control of the μcom channel selection system and numerous functions become available.

IC MN1208 is a 256 bit non-volatile static RAM which can be electrically rewritten. Its capacity is 64 words at 4 bits per word. Tuning voltage data for up to 32 TV channels can be stored.

MN1204 DAC (digital to analog converter) performs pulse duration modulation (PDM) to produce the analog tuning voltage and AFC offset voltage from the digital data of the memory. Because of the PDM signal form, a simple lowpass filter (LPF) can be used in the succeeding stage for obtaining the required analog voltage. The IC also includes band select (VL, VH, J) functions and AFC defeat signal output.

Since other types of interface logic are not required, interfacing among microcomputer sections is very simple.

While monitoring the RF AFC output (S curve) from the tuner section, the CPU increases the tuning voltage. The increase stops at the change in RF AFC output (AFC comparator output).

Afterwards, detection is performed for the presence or absence of a sync signal, and for interference such as intermodulation and imaging. The precise broadcast channel is searched for stable operation.

Because of the numerous functions, a diode encoder system is used for key scanning. Operating key modes are scanned by time sharing.

This tuner/timer circuit also receives coded signals from the remote control unit and performs operation control. See remote control unit circuit description.

3.3.5 Main IC operations

The μcom channel selection system is centered on three ICs, μPD546C-166 (4 bit μcom), MN1204A (DAC) and MN1208 (memory).

1. μPD546C-166

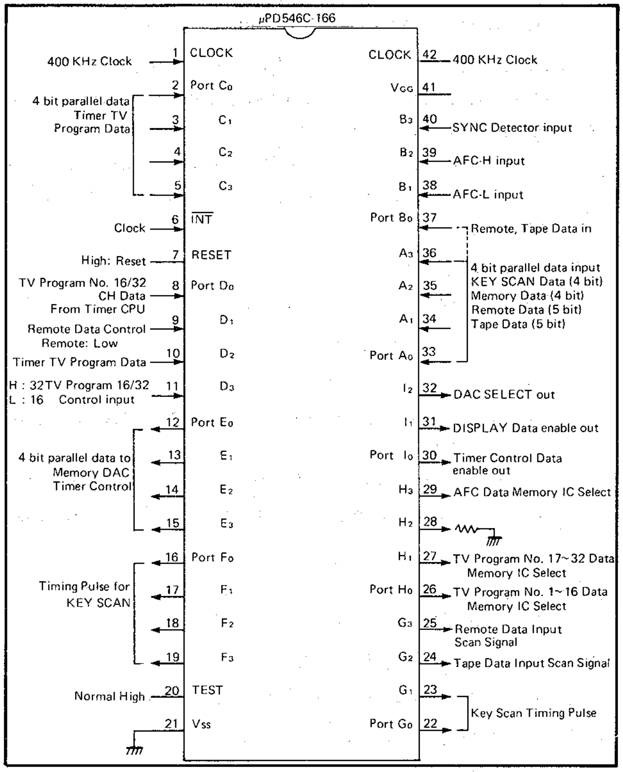

μPD546C-166
400 KHz Clock
4 bit parallel data Timer TV Program Data
Clock
High: Reset
TV Program No. 16/32 CH Data From Timer CPU
Remote Data Control Remote: Low
Timer TV Program Data
H : 32TV Program 16/32
L : 16 Control input
4 bit parallel data to Memory DAC Timer Control
Timing Pulse for KEY SCAN
Normal High
1 CLOCK
2 Port C_0
3 C_1
4 C_2
5 C_3
6 $\overline{INT}$
7 RESET
8 Port D_0
9 D_1
10 D_2
11 D_3
12 Port E_0
13 E_1
14 E_2
15 E_3
16 Port F_0
17 F_1
18 F_2
19 F_3
20 TEST
21 Vss
CLOCK 42
V_{GG} 41
B_3 40
B_2 39
B_1 38
Port B_0 37
A_3 36
A_2 35
A_1 34
Port A_0 33
I_2 32
I_1 31
Port I_0 30
H_3 29
H_2 28
H_1 27
Port H_0 26
G_3 25
G_2 24
G_1 23
Port G_0 22
400 KHz Clock
SYNC Detector input
AFC-H input
AFC-L input
Remote, Tape Data in
4 bit parallel data input
KEY SCAN Data (4 bit)
Memory Data (4 bit)
Remote Data (5 bit)
Tape Data (5 bit)
DAC SELECT out
DISPLAY Data enable out
Timer Control Data enable out
AFC Data Memory IC Select
TV Program No. 17~32 Data Memory IC Select
TV Program No. 1~16 Data Memory IC Select
Remote Data Input Scan Signal
Tape Data Input Scan Signal
Key Scan Timing Pulse

Fig. 3-72 μPD546C

1) Device: P-channel MOS 4 bit μcom (mask ROM type) 42 pin package

2) Power Supply (V_{DD}): 10 V (V_{GG} 0 V)

3) Clock Frequency: 400 kHz

4) Instruction Cycle: Approx. 10 μsec

5) Clock oscillator (pins 1 and 42)
A ceramic filter is connected between these pins to produce 400 kHz oscillation. This is employed as the clock pulse for the microcomputer.

6) Reset terminal (pin 7)
High potential at pin 7 resets the μcom, operation stops and all output ports drop to low potential. The μcom operates when this terminal is at low potential.

7) Test (pin 22)
LSI test terminal; used at high level.

8) Input ports A (pins 33, 34, 35, 36)
4 bit parallel input terminals used as data input bus for key scan data from the key search board, memory data from memory IC, remote control data from the remote control unit, tape remaining data from mechacon, etc.

9) Input ports B (pins 37, 38, 39, 40)
Port B_0 (pin 37): Remote commands from port A mechacon and tape data complementing bit input (4 bits + 1 bit = 5 data bits).

Ports B_1 to B_3 (pins 38, 39, 40); Discrete input terminals for AFC-L, AFC-H and sync detector inputs.

10) Input ports C_0 to C_3 (pins 2, 3, 4, 5) and D_2 (pin 10)
Input ports for TV program no. data from timer CPU. Data inputs are negative logic.

11) Input port D_0 (pin 8)
TV program no. identification input from timer CPU.

12) Input port D_1 (pin 9)
Remote command read identifier from mechacon; remote data are accepted when this terminal is low.

13) Input port D_3 (pin 11)
Input for switching between 16 channel and 32 channel TV program no. Low level is 16 channel and high is 32 channel.

14) Output ports E_0 to E_3 (pins 12, 13, 14, 15)
4 bit parallel outputs; used as output bus for data to memory IC, DAC and display timer control.

15) Output ports F_0 to F_3 (pins 16, 17, 18, 19) and G_0 and G_1 (pins 22, 23)
Timing pulse outputs for key scan to key search board.

16) Output port G_2 (pin 24)
Scan output for inserting 5 bit parallel tape data (TP_0 to TP_4) from mechacon ON data bus.

17) Output port G_3 (pin 25)
Scan output for inserting remote command data from mechacon ON data bus.

18) Output port H_0 (pin 26)
Tuning data memory chip select output for TV program no. 1 to 16; at low pulse, channels 1 to 16 are selected.

19) Output port H_2 (pin 28)
Tuning data memory chip select output for TV program no. 17 to 32.

20) Output port H_3 (pin 29)
Data memory chip select output for AFC offset voltage.

21) Output port I_0 (pin 30)
Enable output for timer control data; approx. 20 msec low pulse.

22) Output port I_1 (pin 31)
Data enable output for display.

23) Output port I_2 (pin 32)
Chip select output for DAC IC.

24) $\overline{\text{INT}}$ output (pin 6)
Return request input to clock mode from timer. Normally high; low during return request (automatic return).

2. µPD650C-049

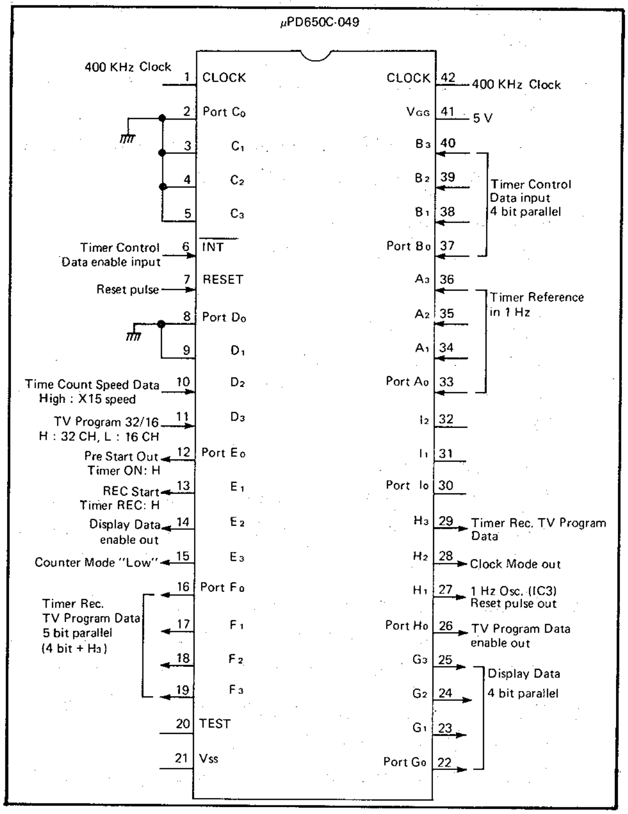

µPD650C-049
400 KHz Clock
1 CLOCK
2 Port C0
3 C1
4 C2
5 C3
Timer Control Data enable input
6 INT
Reset pulse
7 RESET
8 Port D0
9 D1
Time Count Speed Data High : X15 speed
10 D2
TV Program 32/16 H : 32 CH, L : 16 CH
11 D3
Pre Start Out Timer ON: H
12 Port E0
REC Start Timer REC: H
13 E1
Display Data enable out
14 E2
Counter Mode "Low"
15 E3
Timer Rec. TV Program Data 5 bit parallel (4 bit + H3)
16 Port F0
17 F1
18 F2
19 F3
20 TEST
21 Vss
CLOCK 42 400 KHz Clock
VGG 41 5 V
B3 40
B2 39
B1 38
Port B0 37
Timer Control Data input 4 bit parallel
A3 36
A2 35
A1 34
Port A0 33
Timer Reference in 1 Hz
I2 32
I1 31
Port I0 30
H3 29 Timer Rec. TV Program Data
H2 28 Clock Mode out
H1 27 1 Hz Osc. (IC3) Reset pulse out
Port H0 26 TV Program Data enable out
G3 25
G2 24
G1 23
Port G0 22
Display Data 4 bit parallel

Fig. 3-73 µPD650C

1) Device: CMOS 4 bit µcom (mask ROM type) in 42 pin package

2) Power Supply: 5 V (V_{SS} 0 V)

3) Clock Frequency: 400 kHz

4) Instruction Cycle: Approx. 10 µsec

5) Clock oscillator (pins 1 and 42)
A ceramic filter is connected between these terminals to produce 400 kHz oscillation. This is used as the clock pulse for the microcomputer.

6) Reset terminal
High level resets the microcomputer and operations stop; all output ports drop to low potential. Level is low during normal operation.

7) Test terminal (pin 22)
LSI test terminal; used at high level.

8) Input port A_0 (pin 33)
Input for 1 Hz clock reference signal.

9) Input ports B_0 to B_3 (pins 37, 38, 39, 40)
Connected to tuning control (IC1 port E) output bus; inputs for timer control data (see table).

10) Input port D_2 (pin 10)
Timer rate test input; normally used at low level. At high level, clock rate becomes 15 times normal.

11) Input port D_3 (pin 11)
Selector output for TV program no. Low for 16 channels; high for 32 channels.

12) Output ports E_0 and E_1 (pins 12 and 13)
High level appears at E_0 prestart output 10 seconds before the timer set time.
Timer REC start output E_1 goes high at the timer set time and low after the recording length time elapses.

13) Output port E_2 (pin 14)
Data enable output for display.

14) Output port E_3 (pin 15)
Low level during counter mode.

15) Output ports F_0 to F_3 (pins 16, 17, 18, 19) and H_3 (pin 29)
Outputs are produced from TV program no. 5 bit parallel data during timer REC and timer program set.

16) Output ports G_0 to G_3 (pins 22, 23, 24, 25)
4 bit parallel data outputs for display.

17) Output port H_0 (pin 26)
Data enable output for TV program no.

18) Output port H_1 (pin 27)
Reset output for 1 Hz oscillator (IC3).

19) Output port H_2 (pin 28)
Return request output to clock mode.

20) $\overline{\text{INT}}$ input terminal (pin 6)
Enables timer control data output from tuner control (IC1).

3. MN1208 (IC5, 7, 8)

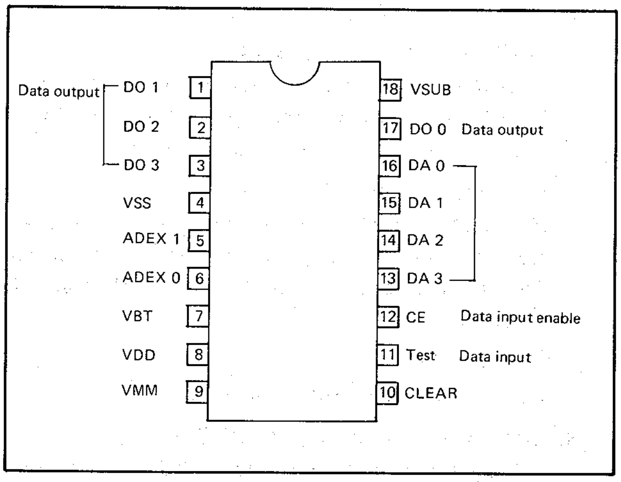

Data output
DO 1 1
DO 2 2
DO 3 3
VSS 4
ADEX 1 5
ADEX 0 6
VBT 7
VDD 8
VMM 9
18 VSUB
17 DO 0 Data output
16 DA 0
15 DA 1
14 DA 2
13 DA 3
12 CE Data input enable
11 Test Data input
10 CLEAR

Fig. 3-74 MN1208

1) Device: MNOS type 18 pin 256 bit +12 bit EAROM (electrically alterable read only memory)

2) Power Supply: Vss 10 V; Vdol 0 V; V_{BT} 3.5 V; V_{MM} −23 V

3) Input ports D_0 to D_3 (pins 13, 14, 15, 16)
4 bit parallel inputs for mode, address and data.

4) $\overline{CE}$ input terminal (pin 12)
Enable for input at port D_A.

5) Output ports D_{O0} to D_{O3} (pins 1, 2, 3, 17)
Data outputs.

6) PCLA (pin 10)
Power on clear input; goes low approx. 100 msec after memory power on.

4. MN1204A

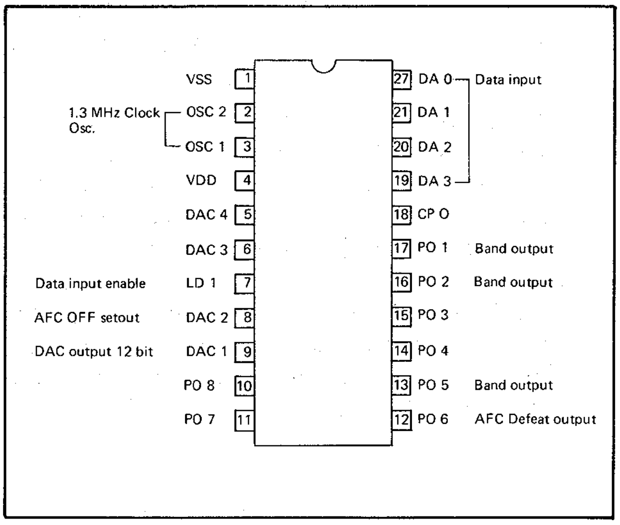

VSS
1
1.3 MHz Clock Osc.
OSC 2
2
OSC 1
3
VDD
4
DAC 4
5
DAC 3
6
Data input enable
LD 1
7
AFC OFF setout
DAC 2
8
DAC output 12 bit
DAC 1
9
PO 8
10
PO 7
11
27
DA 0
Data input
21
DA 1
20
DA 2
19
DA 3
18
CP O
17
PO 1
Band output
16
PO 2
Band output
15
PO 3
14
PO 4
13
PO 5
Band output
12
PO 6
AFC Defeat output

Fig. 3-75 MN1204A

1) Device: N channel MOS DAC (digital to analog converter) 22 pin package

2) Power Supply: 5 V

3) Clock Frequency: 1.3 MHz

4) Clock oscillator (pins 2 and 3)
An oscillator circuit is composed by connecting LCR (inductance, capacitance and resistance); oscillation frequency is 1.3 MHz.

5) Input ports D_{A0} to D_{A3} (pins 19, 20, 21, 22)
Parallel input ports for address data.

6) LD_1 input terminal (pin 7)
Enable input for 4 bit data at D_{A0} to D_{A3}.

7) DAC_1 output terminal (pin 9)
PDM output for tuner voltage (12 bits).

8) DAC_2 output terminal (pin 6)
PDM output (2 bits) for tuning voltage complement.

9) DAC_3 output terminal (pin 6)
PDM output (4 bits) for AFC offset voltage.

10) $P_{O1, 2, 5}$ output terminals (pins 17, 16, 13)
Outputs for selecting receiving band.

11) P_{O6} output terminal (pin 12)
AFC defeat output.

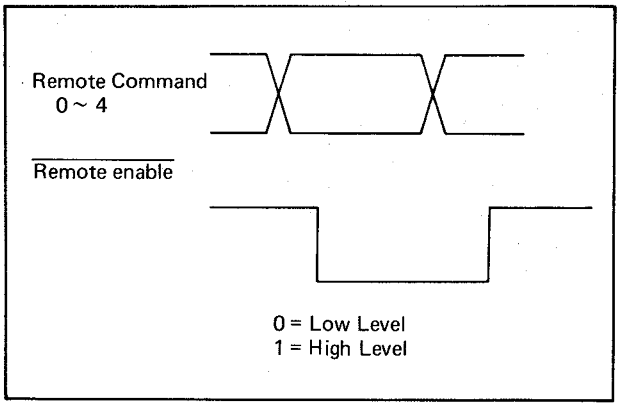

Remote Command
0 ~ 4
Remote enable
0 = Low Level
1 = High Level

Fig. 3-76

Remote control code table

RM4	RM3	RM2	RM1	RM0	MODE
1	0	0	0	0	TV PROG. = 1
1	0	0	0	1	TV PROG. = 2
1	0	0	1	0	TV PROG. = 3
1	0	0	1	1	TV PROG. = 4
1	0	1	0	0	TV PROG. = 5
1	0	1	0	1	TV PROG. = 6
1	0	1	1	0	TV PROG. = 7
1	0	1	1	1	TV PROG. = 8
1	1	0	0	0	TV PROG. = 9
1	1	0	0	1	TV PROG. = 10
1	1	0	1	0	TV PROG. = 11
1	1	0	1	1	TV PROG. = 12
1	1	1	0	0	TV PROG. = 13
1	1	1	0	1	TV PROG. = 14
1	1	1	1	0	TV PROG. = 15
0	0	0	0	1	CLOCK MODE
0	0	0	1	0	COUNTER MODE
0	0	0	1	1	PROG. MODE
0	0	1	0	0	SELECT
0	0	1	0	1	SET
0	0	1	1	0	CANCEL
0	0	1	1	1	PROG. NO.
0	1	0	0	0	REPEAT
0	1	0	0	1	CLOCK SET MODE
0	1	1	1	0	TV PROG. SHIFT
0	1	1	1	1	TV PROG. = 16

Table 3-13

0: Low level
1: High level

TAPE POSITION DATA (TP0~4) TABLE

TP4	TP3	TP2	TP1	TP0	1	2	3	4	5	6	7	8	9	10
1	0	1	0	1	1	1	1	1	1	1	1	1	1	1
1	0	1	1	0	0	1	1	1	1	1	1	1	1	1
1	0	1	1	1	0	0	1	1	1	1	1	1	1	1
1	1	0	0	0	0	0	0	1	1	1	1	1	1	1
1	1	0	0	1	0	0	0	0	1	1	1	1	1	1
1	1	0	1	0	0	0	0	0	0	1	1	1	1	1
1	1	0	1	1	0	0	0	0	0	0	1	1	1	1
1	1	1	0	0	0	0	0	0	0	0	0	1	1	1
1	1	1	0	1	0	0	0	0	0	0	0	0	1	1
1	1	1	1	0	0	0	0	0	0	0	0	0	0	1
1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
0	1	1	0	1	0	0	0	0	0	0	0	0	0	1*

0 : Low Level
1 : High Level

0 : OFF
1 : ON
1*: ON/OFF

Table 3-14

3.3.6 Auto TV program search circuit

Nearly all the circuits of the tuner/timer section are digital. However, since the tuning circuit functions in the manner of a digital to analog interface, an outline of its operation is provided below.

1. **Tuning potential generator**

   As shown in the block diagram, an approx. 5 Vp-p PDM signal from the DAC is converted to a 30 Vp-p PDM signal. Through an LPF, this becomes the DC tuning voltage BT. Thus, according to the duty ratio of the output pulse from the DAC, a 0 to 30 VDC voltage is produced as the AFC BT potential.

   The 3.5 msec repeating pulse output from IC9 (DAC) pin 9 is in the form of pulse duration modulation and controlled by 4 bit input data to IC9. With 12 bit control, the resolving capability of the DAC becomes $2^{12} = 4096$ steps. Therefore, the pulse width of the pin 9 output varies at a nearly fixed rate.

   At electronic switch X10, by using 30 VDC (from AFC) of the IF board, the pulse width variation of the 5 Vp-p DAC output is converted into a voltage variation of from 0 to 30 Vp-p. When the pulse width varies, since the peak to peak value of the pulse also varies, an LPF is used to obtain a differentiated DC voltage. A trap circuit reduces the latent 3.5 msec ripple component to an acceptable value. The resulting DC voltage then goes to the TUNER/IF board as BT.

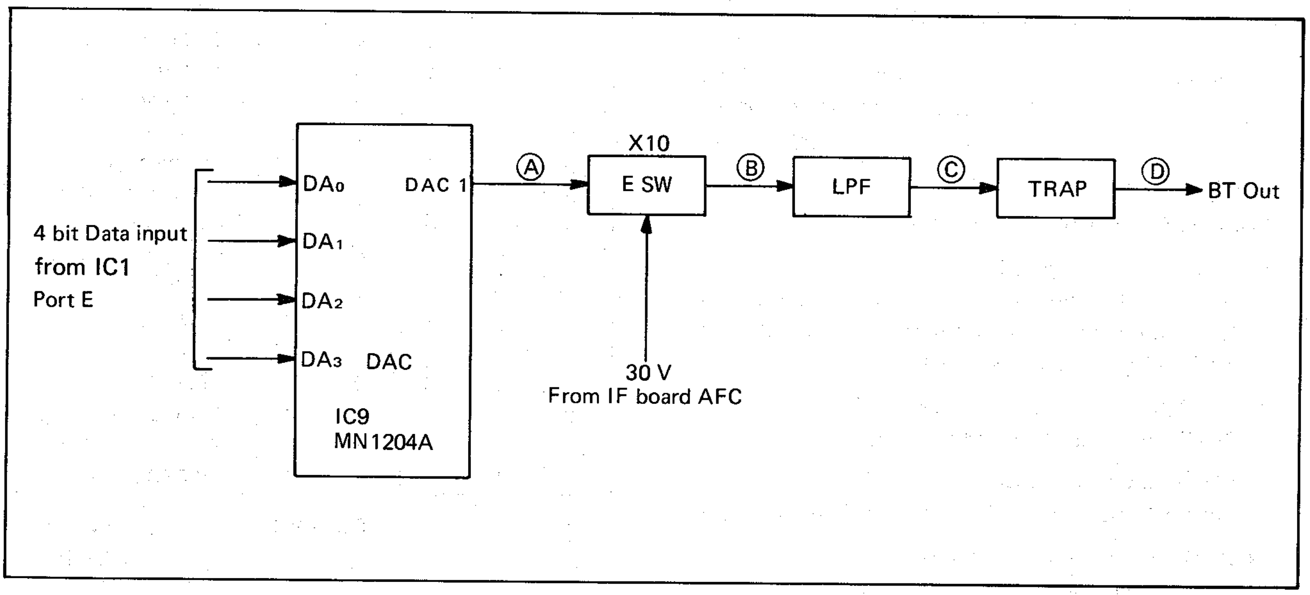


Fig. 3-77

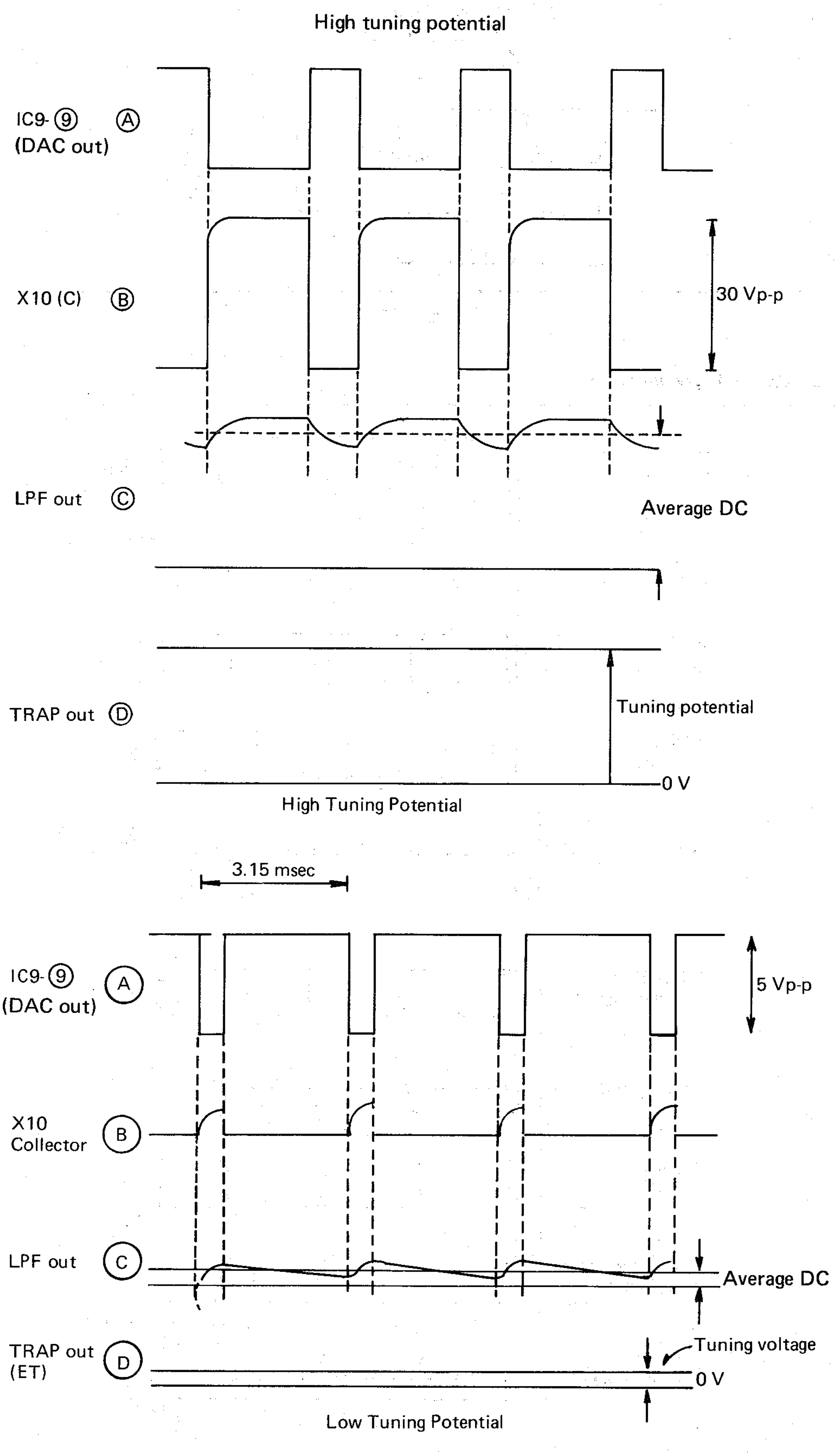
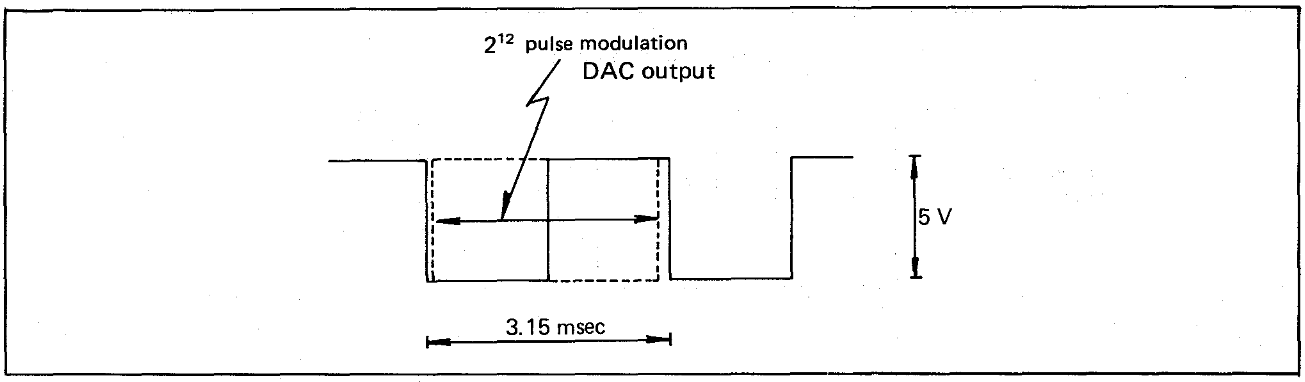

High tuning potential
IC9-⑨ Ⓐ
(DAC out)
X10 (C) Ⓑ
30 Vp-p
LPF out Ⓒ
Average DC
TRAP out Ⓓ
Tuning potential
0 V
High Tuning Potential
3.15 msec
IC9-⑨ Ⓐ
(DAC out)
5 Vp-p
X10
Collector Ⓑ
LPF out Ⓒ
Average DC
TRAP out Ⓓ
(ET)
Tuning voltage
0 V
Low Tuning Potential

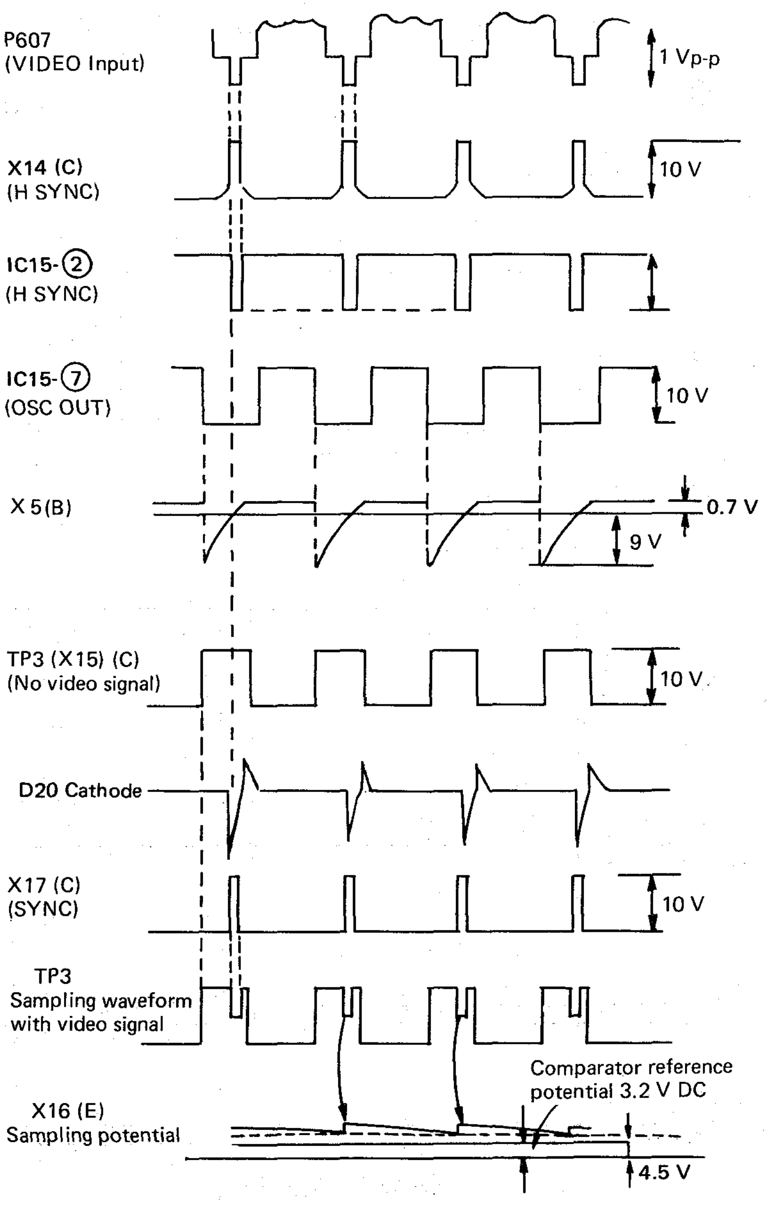
Fig. 3-78



2^{12} pulse modulation
DAC output
5 V
3.15 msec

Fig. 3-79

2. H. sync separator and sync detector



P607
(VIDEO Input)
1 Vp-p
X14 (C)
(H SYNC)
10 V
IC15-②
(H SYNC)
IC15-⑦
(OSC OUT)
10 V
X 5 (B)
0.7 V
9 V
TP3 (X15) (C)
(No video signal)
10 V
D20 Cathode
X17 (C)
(SYNC)
10 V
TP3
Sampling waveform
with video signal
Comparator reference
potential 3.2 V DC
X16 (E)
Sampling potential
4.5 V

Fig. 3-80

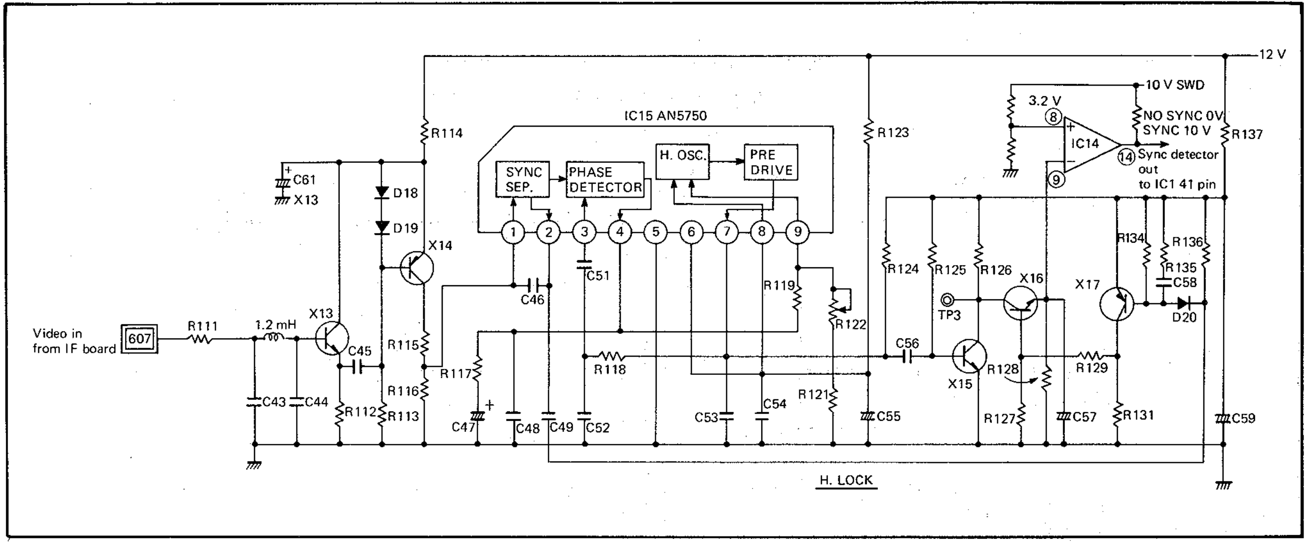

Video in from IF board
607
R111
1.2 mH
C43
C44
X13
C61
X13
R112
C45
R113
D18
D19
X14
R114
R115
R116
R117
C46
C47
+
C48
C49
C52
C51
R118
IC15 AN5750
SYNC SEP.
PHASE DETECTOR
H. OSC.
PRE DRIVE
1
2
3
4
5
6
7
8
9
C53
C54
R119
R121
R122
R123
C55
H. LOCK
12 V
10 V SWD
3.2 V
8
+
−
IC14
9
14
NO SYNC 0V
SYNC 10 V
Sync detector out to IC1 41 pin
R137
R124
R125
R126
TP3
X16
C56
X15
R128
R127
R129
C57
X17
R131
R134
R136
R135
C58
D20
C59

Fig. 3-81

The video output signal from the TUNER/IF board goes to terminal P607 of the T/T board. An LPF composed of R111, L2, C43 and C44 attenuates the high frequency component of the signal. Following X13, the sync component is DC clamped by D18 and D19, and at X14, only the sync component is amplified. This output is obtained at reverse polarity from X14 collector. See sync detector timing chart.

From this point, the inverted sync signal goes to IC15 (AN5750) pin 1. This is an emitter grounded NPN transistor base input with an operating point (threshold level) of approx. 0.7 V.

At X14 collector, the sync signal still contains an element of the video signal component. This sync signal, at about 10 Vp-p, is reduced to about 1/10th level by R115 (10 kΩ) and R116 (150 kΩ), then supplied to IC15 pin 1. The noise (video) component is removed and the resulting sync signal goes to the phase detector.

IC15 contains a horizontal oscillator which is always locked in phase with the input video signal. By sampling this output from pin 7 with the separated sync component of the input video signal, a DC voltage is obtained which changes according to the presence or absence of sync. From pin 4, this output goes to the positive terminal of comparator IC14 pin 9. The digital output from IC14 pin 14 is high in the presence of sync and low in its absence. The resulting output is supplied as the sync detector input to CPU IC1 pin 41.

3. AFC comparator

This circuit converts the analog AFC voltage (S curve) into digital form. The AFC voltage via terminal 609 goes to IC14 comparator. According to the tuning status, the resulting AFC-H or AFC-L digital pulse is sent to the microcomputer to perform search speed control. In absence of a signal, the tuning rates in the auto search mode are as follows.

Band I:	12 seconds/band
Band III:	20 seconds/band
Band U:	50 seconds/band

Tuning starts at the above rates when the corresponding BAND button is pressed, i.e., the tuning voltage increases to produce these rates.

When sync is detected in this mode, IC14 pin 14 goes high and a high input appears at CPU IC1 port B_3. After a brief delay time, the CPU controlled tuning rate drops to about 1/3rd, then again increases. As tuning proceeds, the S-curve AFC voltage from the TUNER/IF board varies. This variation is applied to the positive input of the AFC-H comparator at IC14 pin 11 and the negative input of the AFC-L comparator at IC14 pin 4.

At the point the AFC voltage exceeds approx. 8 V, low output from AFC-L comparator IC14 pin 2 goes to CPU IC1 port B_1. After a fixed delay period, the tuning rate drops to about 1/8th, and tuning continues at a rate conductive to fine tuning. During tuning at 1/8th speed, when a signal frequency is approached, the AFC voltage declines below the 8 V AFC-L comparator reference. The AFC-L comparator output at IC14 pin 2 goes high and high again appears at IC1 port B_1.

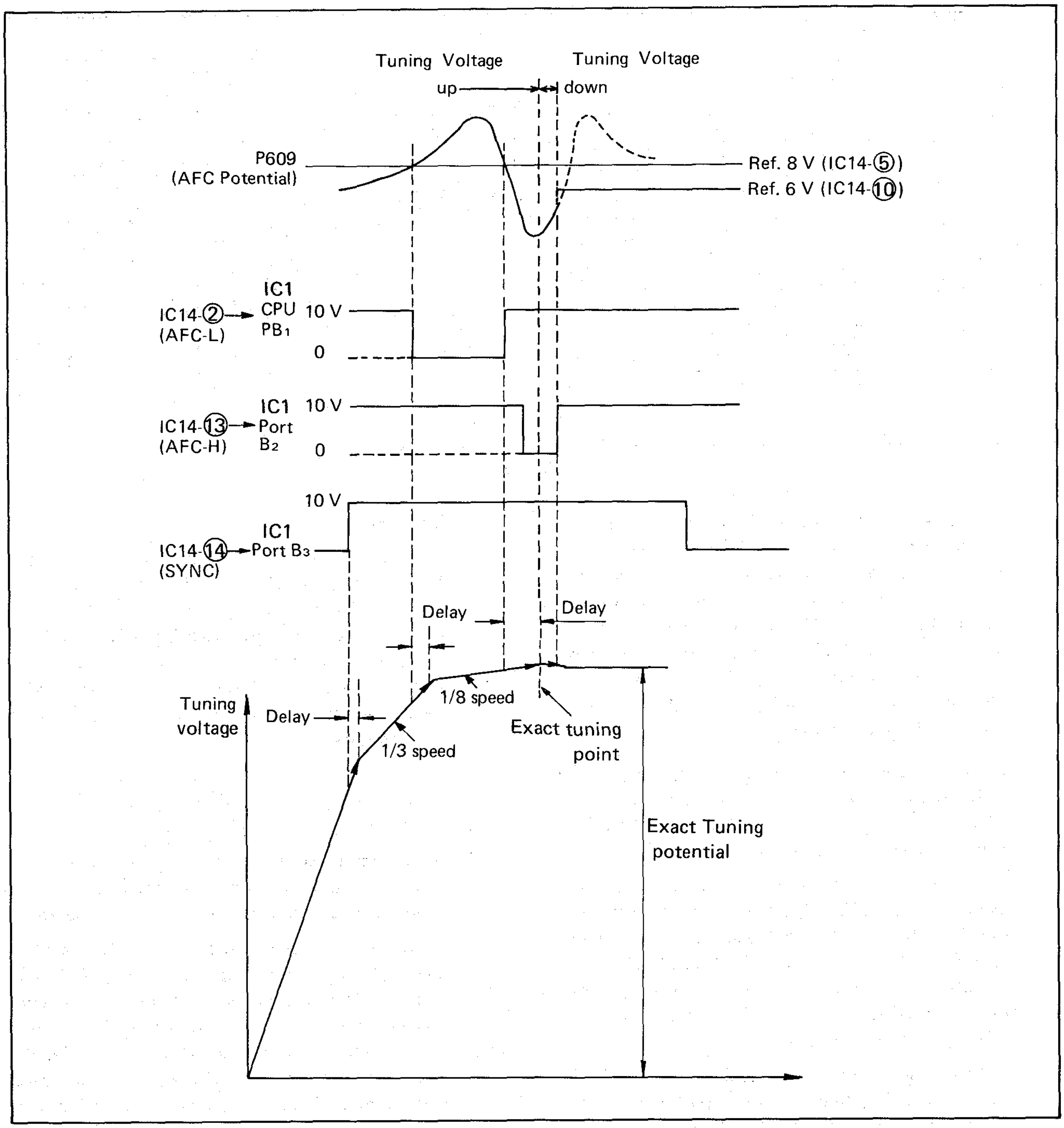

Tuning Voltage up
Tuning Voltage down
P609 (AFC Potential)
Ref. 8 V (IC14-⑤)
Ref. 6 V (IC14-⑩)
IC14-② (AFC-L)
IC1 CPU PB1
10 V
0
IC14-⑬ (AFC-H)
IC1 Port B2
10 V
0
10 V
IC14-⑭ (SYNC)
IC1 Port B3
Delay
Delay
Delay
1/8 speed
1/3 speed
Exact tuning point
Tuning voltage
Exact Tuning potential

Fig. 3-82 Auto program search time chart

However, the 1/8th rate tuning voltage passes the exact tuning point and continues to increase for a fixed time period until the AFC-H comparator output goes low. When the pulse side of the AFC-H comparator at IC14 pin 11 declines below about 6 VDC, a low output from pin 13 goes to IC1 port B2 (pin 37).

Since the 1/8th speed tuning voltage exceeds the tuning center point, the tuning process reverses. At about 1/30th speed, the tuning voltage declines until the AFC-H comparator output at IC14 pin 13 goes high. Thus, the tuning voltage is reduced until the AFC voltage rises to the point beyond the 6 VDC AFC-H comparator reference voltage. This becomes the center tuning point.

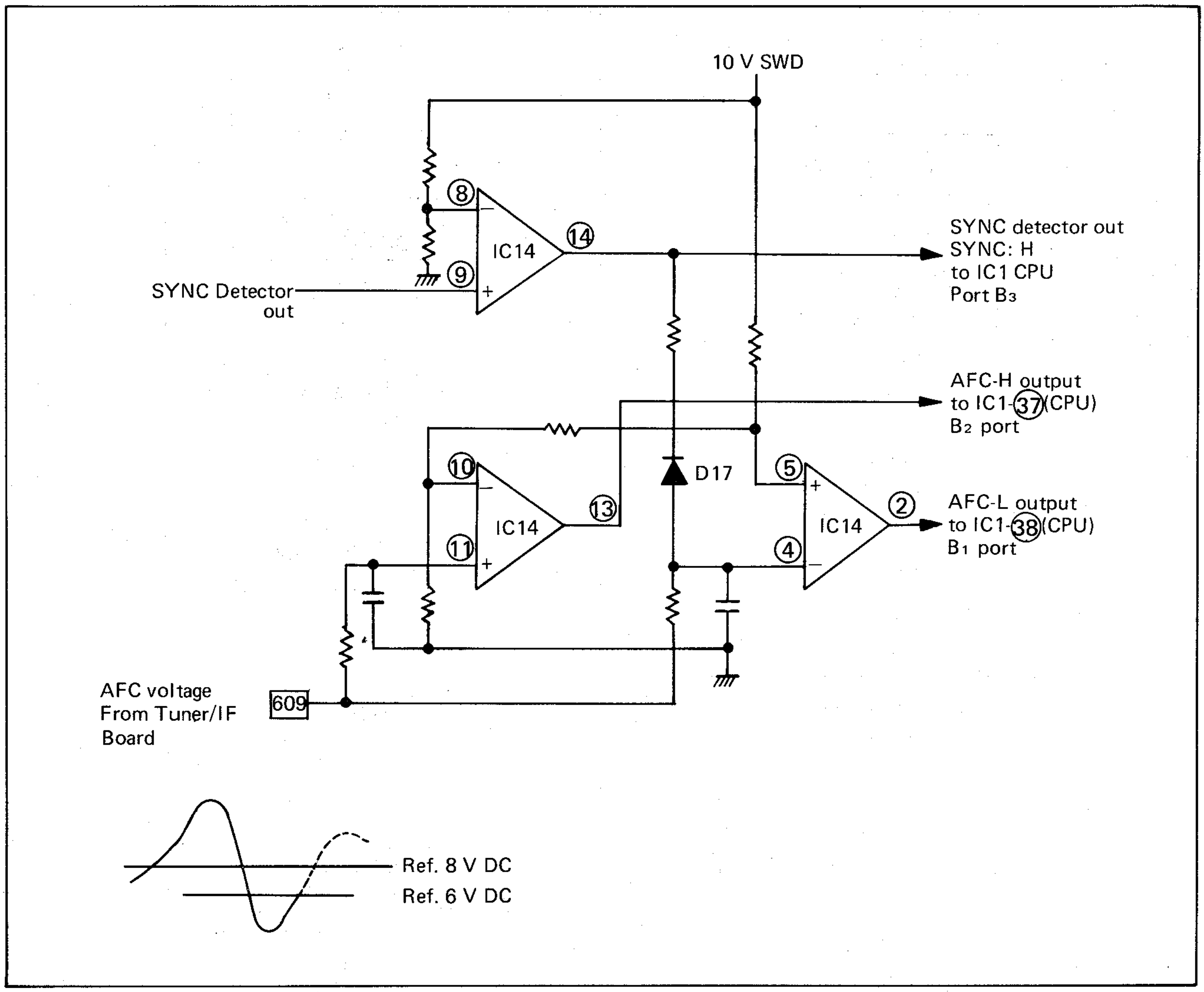

10 V SWD
⑧
⑨
⑭
IC14
SYNC Detector out
SYNC detector out
SYNC: H
to IC1 CPU
Port B3
AFC-H output
to IC1-㊲(CPU)
B2 port
⑩
⑪
⑬
IC14
D17
⑤
④
IC14
②
AFC-L output
to IC1-㊳(CPU)
B1 port
AFC voltage
From Tuner/IF
Board
609
Ref. 8 V DC
Ref. 6 V DC

Fig. 3-83 Auto program search circuit

4. Auto Search Operation

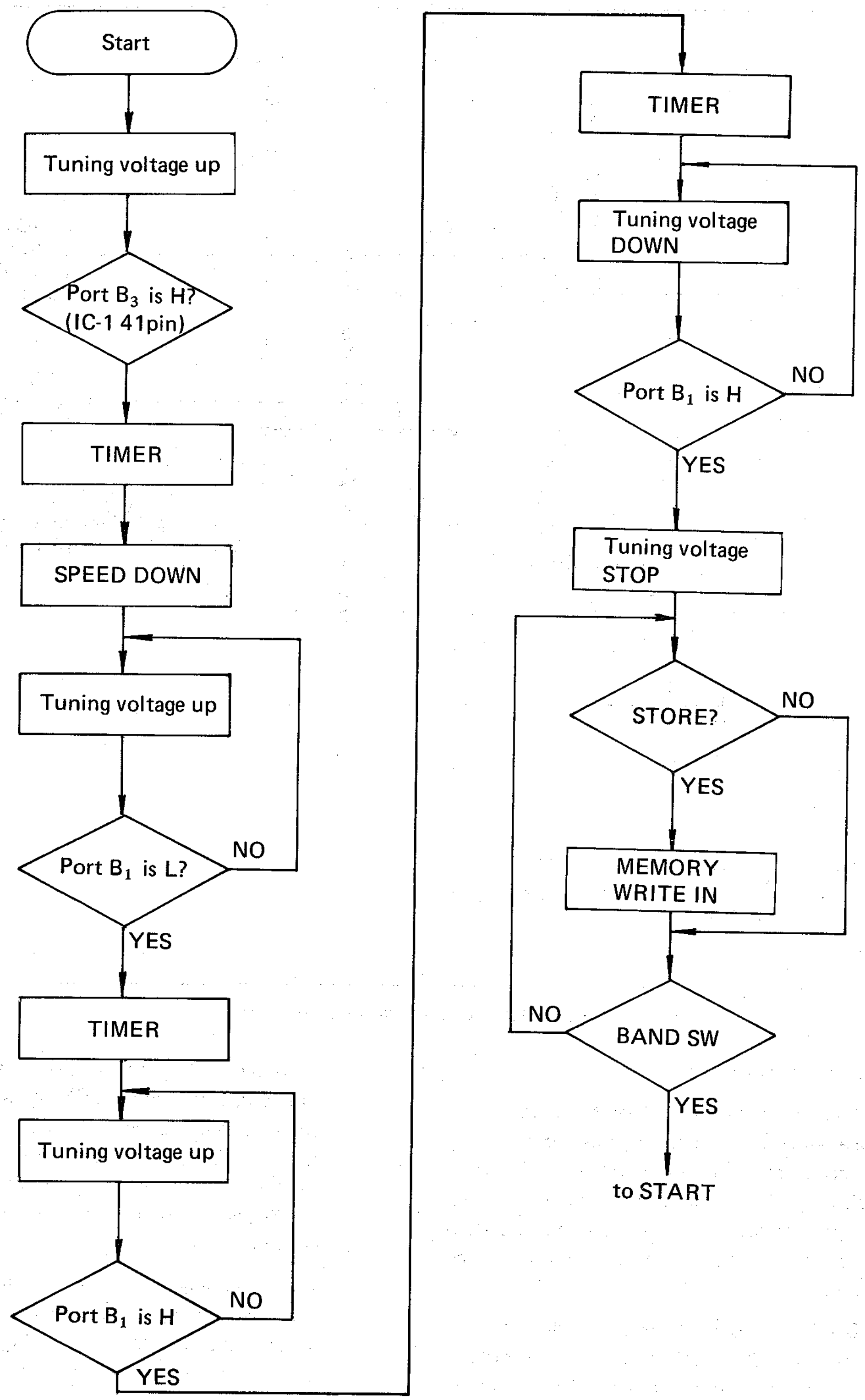
The CPU controls the auto search operation in accordance with the previously described tuning potential generator, sync detector and AFC comparator circuits. Since the auto search and manual search operations are basically the same, the auto search operation is described below in reference to the flow chart.

When a BAND button is pressed, while monitoring the state of CPU IC1 sync detector output (port B_3), the 4 bit signal from IC1 port E is sent to IC9 DAC. The DAC output pulse increases in width at a fixed rate and the tuning control voltage (BT) rises. At this time, if a video signal is detected in the tuner output, the sync detector high output appears at IC1 port B_3. After a fixed delay time (due to the time constant of the LPF circuit in the DAC output), the CPU reduces the tuning rate to 1/3rd. Tuning continues at this rate and the tuning voltage rises until the AFC-L comparator output drops low.

With low at IC1 port B_1, after a fixed delay period, the tuning rate drops to 1/8th and the tuning voltage continues to rise. At this time, when the AFC-L comparator again goes high, after a fixed delay, the CPU lowers the tuning voltage. This reduction continues until the AFC-H comparator output goes high.

At the change from low to high at IC1 port B_1, the best tuning state is detected and the tuning voltage stops. The auto tuning operation is then completed by storing this tuning voltage value in the memory IC.

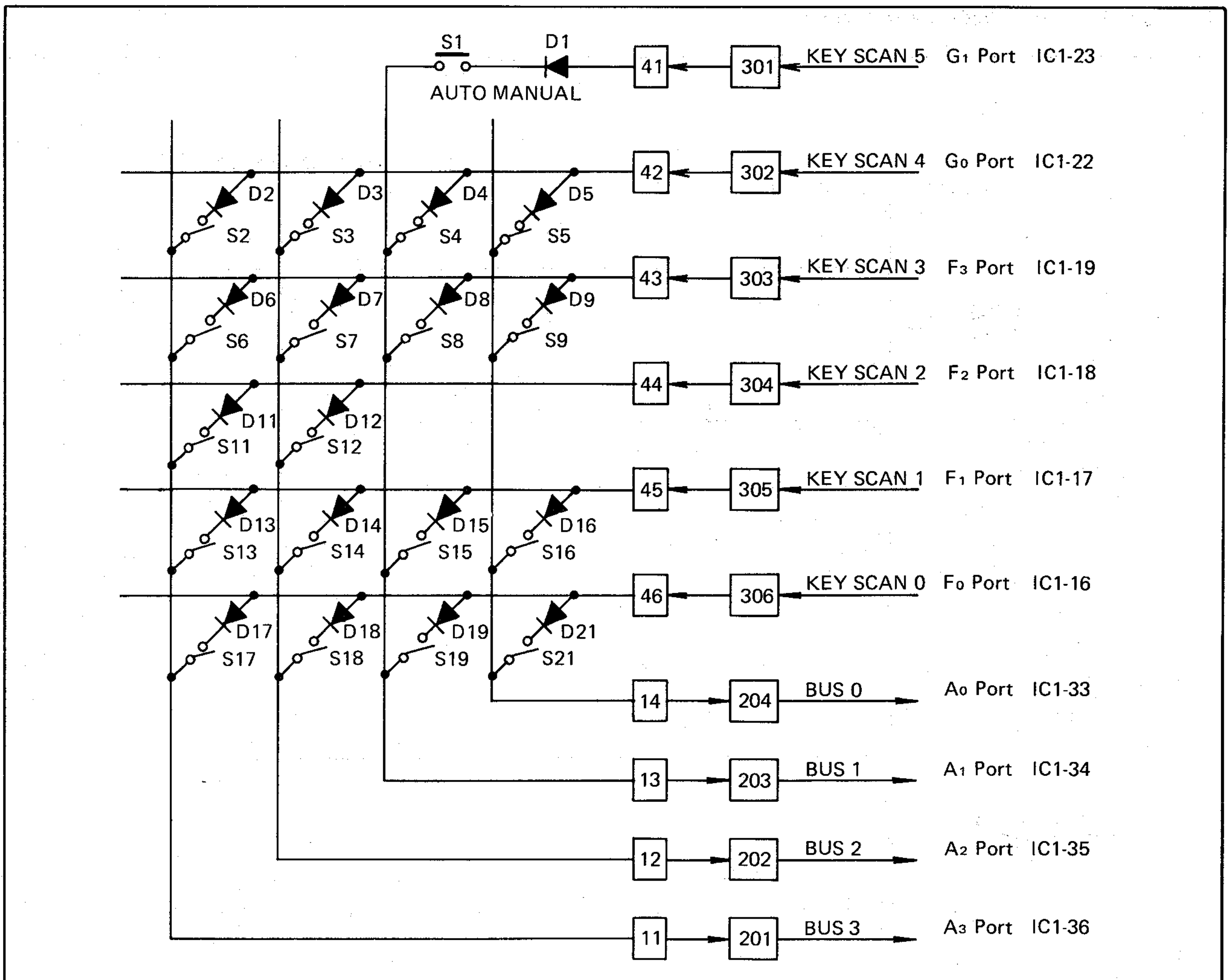
Auto Search Flow chart


Start
Tuning voltage up
Port B3 is H? (IC-1 41pin)
TIMER
SPEED DOWN
Tuning voltage up
Port B1 is L?
NO
YES
TIMER
Tuning voltage up
Port B1 is H
NO
YES
TIMER
Tuning voltage DOWN
Port B1 is H
NO
YES
Tuning voltage STOP
STORE?
NO
YES
MEMORY WRITE IN
BAND SW
NO
YES
to START

5. **Key Scan Matrix Circuit**

In normal modes, key scan pulse outputs are obtained from IC1 ports Fo to F3 and Go and G1. Pressing an operating key produces a pulse input to CPU port A. Pulse outputs at deviated times are then obtained from ports F and G.

The data are loaded at CPU port A by the pulse timing T1 of Fo. At this time, if the FINE TUNING (+ or –) or TV PROGRAM (+ or –) key is pressed, the output of CPU port Fo goes through one of the diodes D17, D18, D19 or D21 to CPU port A. By then reading the pulse code at port A, the CPU can determine which key has been pressed.


S1
D1
AUTO MANUAL
41
301
KEY SCAN 5
G_1 Port
IC1-23
42
302
KEY SCAN 4
G_0 Port
IC1-22
43
303
KEY SCAN 3
F_3 Port
IC1-19
44
304
KEY SCAN 2
F_2 Port
IC1-18
45
305
KEY SCAN 1
F_1 Port
IC1-17
46
306
KEY SCAN 0
F_0 Port
IC1-16
D2
S2
D3
S3
D4
S4
D5
S5
D6
S6
D7
S7
D8
S8
D9
S9
D11
S11
D12
S12
D13
S13
D14
S14
D15
S15
D16
S16
D17
S17
D18
S18
D19
S19
D21
S21
14
204
BUS 0
A_0 Port
IC1-33
13
203
BUS 1
A_1 Port
IC1-34
12
202
BUS 2
A_2 Port
IC1-35
11
201
BUS 3
A_3 Port
IC1-36

S2 COUNTER	S3 CLOCK	S4 PROGRAM	S5 CLOCK SET
S6 PRG. NO.	S7 CANCEL	S8 SET	S9 SELECT
S11 PRG. REPEAT	S12 STORE		
S13 BAND U	S14 BAND Ⅲ	S15 CH SET MODE	S16 BAND I
S17 FINE TUNE (−)	S18 FINE TUNE (+)	S19 TV PROGRAM(+)	S21 TV PROGRAM (−)

Fig. 3-84

Timer control code table (IC2 pin 37 – 40)

Code	B_3	B_2	B_1	B_0	Function
0	0	0	0	0	CLOCK MODE
1	0	0	0	1	CLOCK SET MODE
2	0	0	1	0	PROG. SET MODE
3	0	0	1	1	SELECT
4	0	1	0	0	SET
5	0	1	0	1	CANCEL
6	0	1	1	0	ALL CANCEL
7	0	1	1	1	PROG. No.
8	1	0	0	0	REPEAT
9	1	0	0	1	KEY OFF
A	1	0	1	0	COUNTER MODE
B	1	0	1	1	DIMMER ON
C	1	1	0	0	DIMMER OFF

0 : Low
1 : High

Table 3-15

6. 10 V SWD (switched) Control circuit

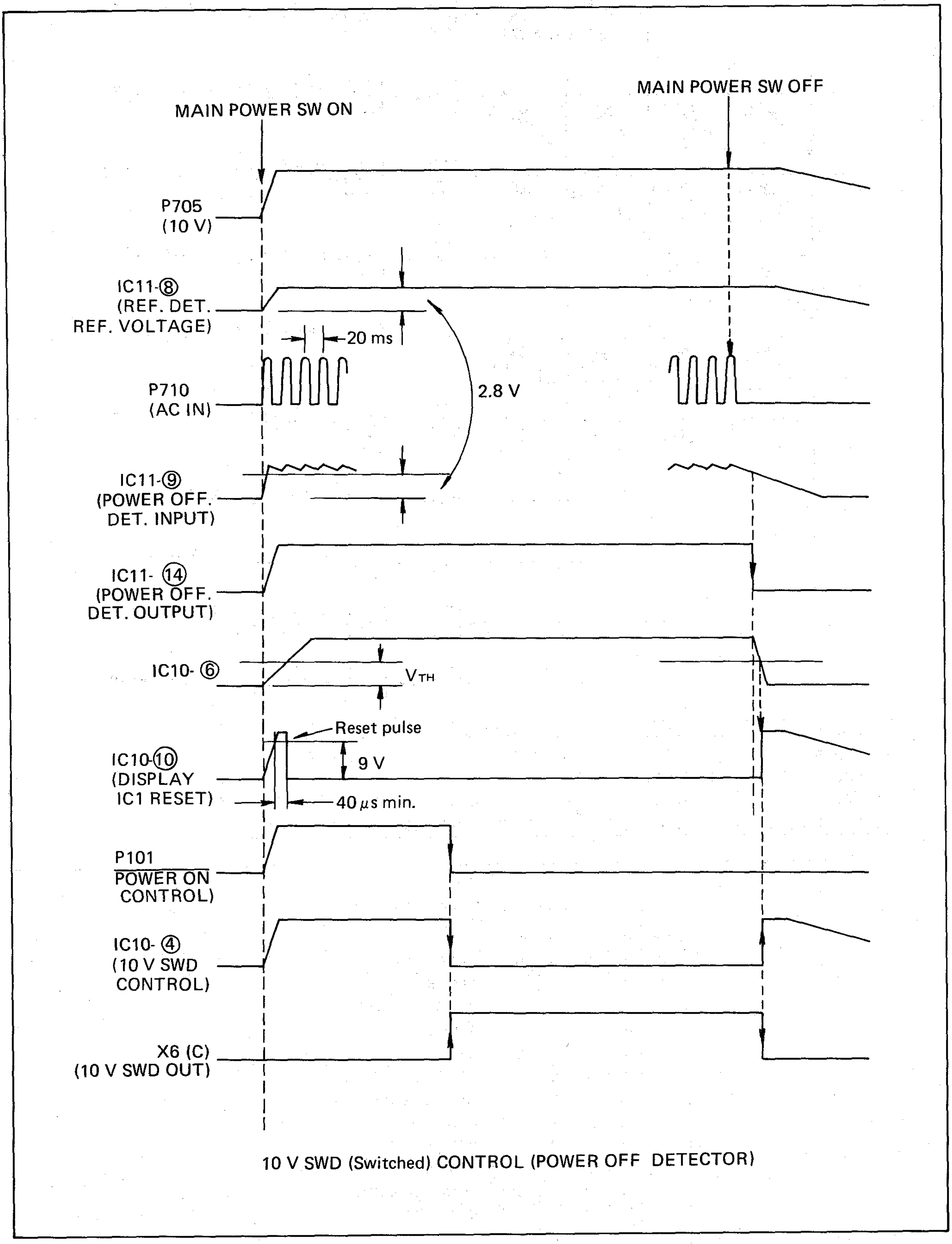

MAIN POWER SW ON
MAIN POWER SW OFF
P705
(10 V)
IC11-⑧
(REF. DET.
REF. VOLTAGE)
20 ms
P710
(AC IN)
2.8 V
IC11-⑨
(POWER OFF.
DET. INPUT)
IC11- ⑭
(POWER OFF.
DET. OUTPUT)
IC10- ⑥
VTH
Reset pulse
IC10-⑩
(DISPLAY
IC1 RESET)
9 V
40 µs min.
P101
POWER ON
CONTROL)
IC10- ④
(10 V SWD
CONTROL)
X6 (C)
(10 V SWD OUT)
10 V SWD (Switched) CONTROL (POWER OFF DETECTOR)

Fig. 3-85

10 V SWD (switched) control circuit

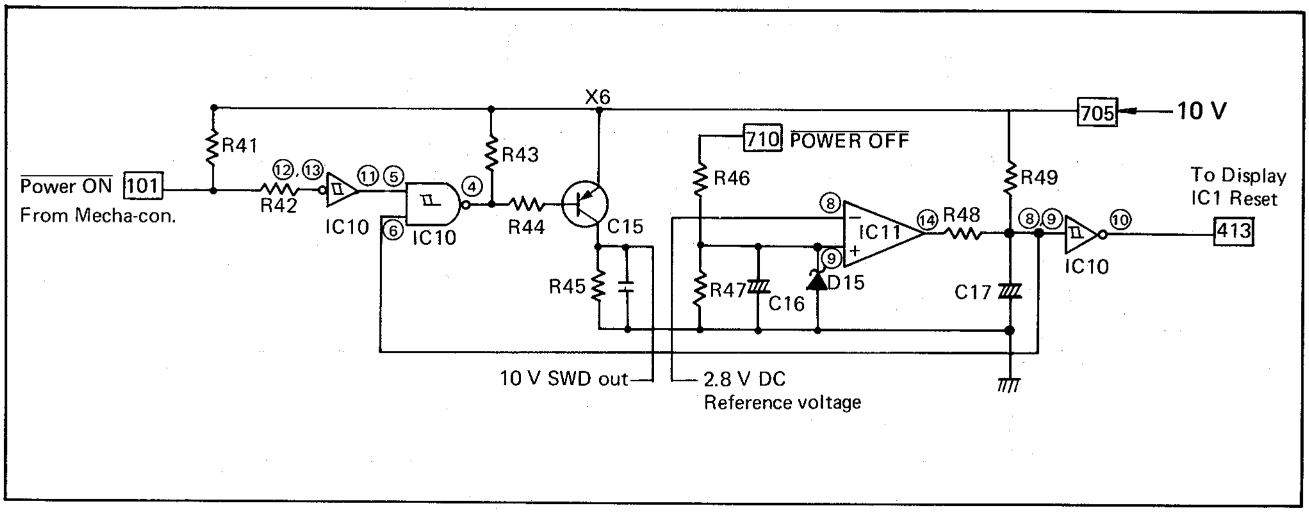

X6
705
10 V
710
POWER OFF
R41
R43
Power ON
101
From Mecha-con.
R42
⑫,⑬
⑪⑤
④
IC10
⑥
IC10
R44
C15
R45
R46
R49
To Display
IC1 Reset
⑧
IC11
⑭
R48
⑧⑨
⑩
413
IC10
⑨
R47
C16
D15
C17
10 V SWD out
2.8 V DC
Reference voltage

Fig. 3-86

7. Reset pulse generator circuit

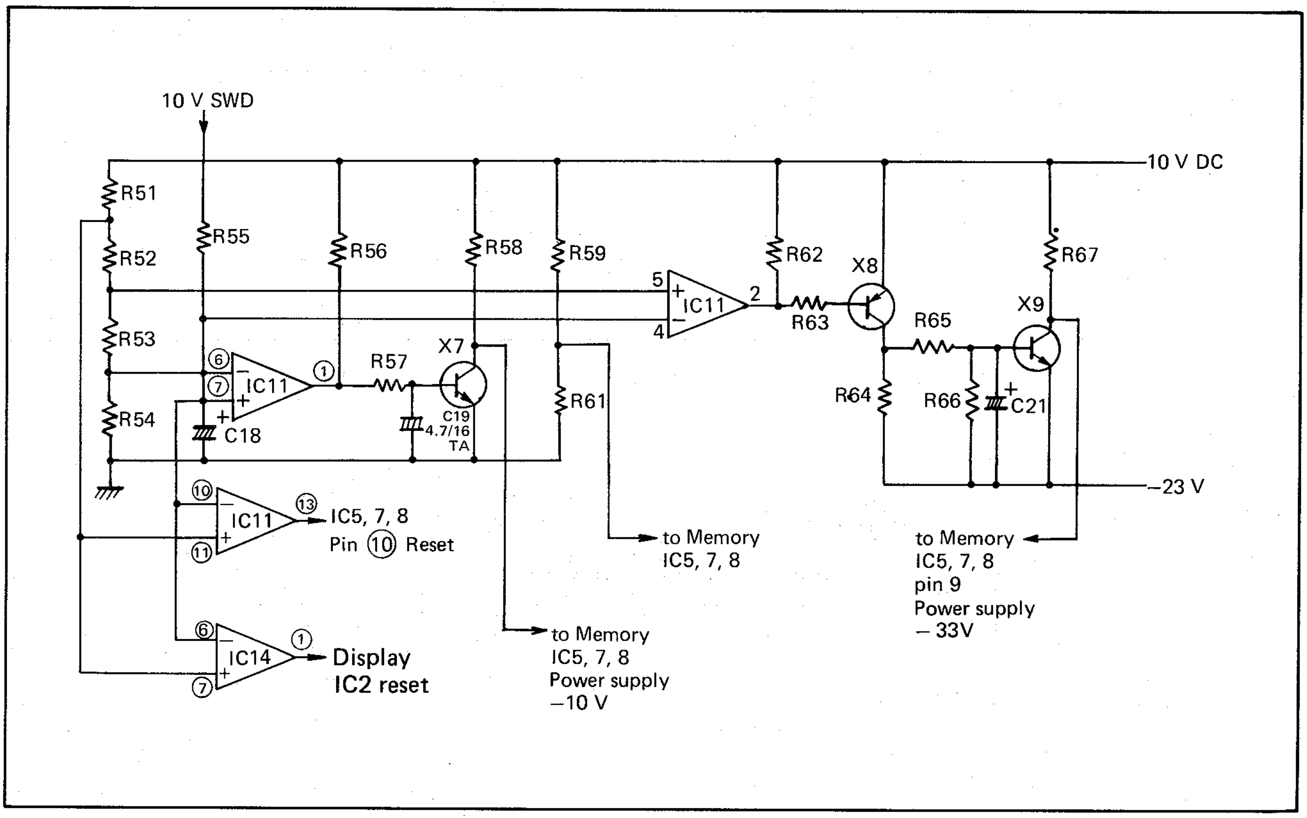

10 V SWD
10 V DC
R51
R52
R53
R54
R55
R56
R58
R59
R62
R67
X8
X9
5
IC11
2
4
R63
R65
⑥
⑦
IC11
①
R57
X7
C18
C19
4.7/16
TA
R61
R64
R66
C21
−23 V
⑩
IC11
⑪
⑬
IC5, 7, 8
Pin ⑩ Reset
to Memory
IC5, 7, 8
to Memory
IC5, 7, 8
pin 9
Power supply
− 33V
⑥
IC14
⑦
①
Display
IC2 reset
to Memory
IC5, 7, 8
Power supply
−10 V

Fig. 3-87

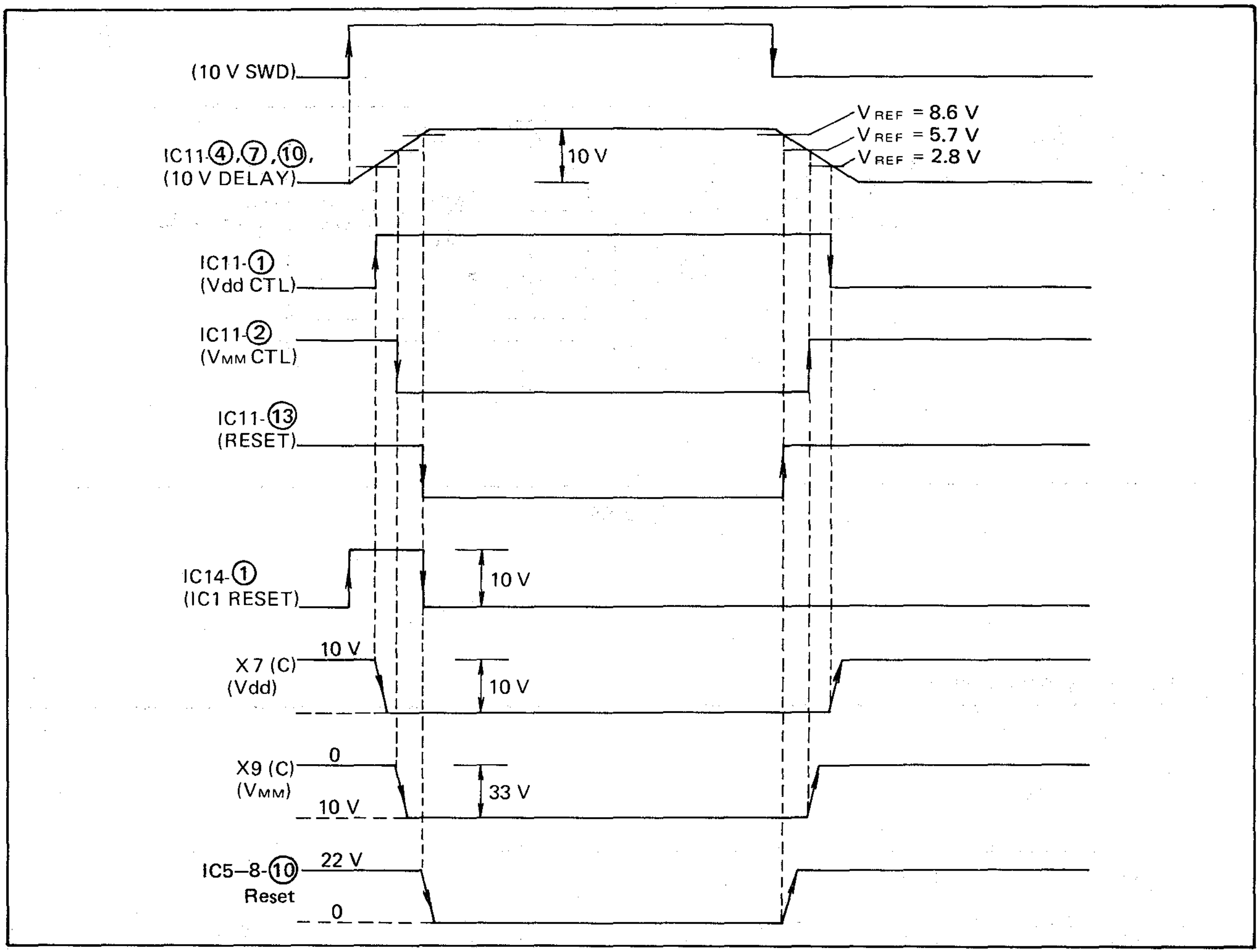

(10 V SWD)
IC11-④,⑦,⑩,
(10 V DELAY)
10 V
V REF = 8.6 V
V REF = 5.7 V
V REF = 2.8 V
IC11-①
(Vdd CTL)
IC11-②
(VMM CTL)
IC11-⑬
(RESET)
IC14-①
(IC1 RESET)
10 V
X 7 (C)
(Vdd)
10 V
10 V
X9 (C)
(VMM)
0
10 V
33 V
IC5–8-⑩
Reset
22 V
0

Fig. 3-88

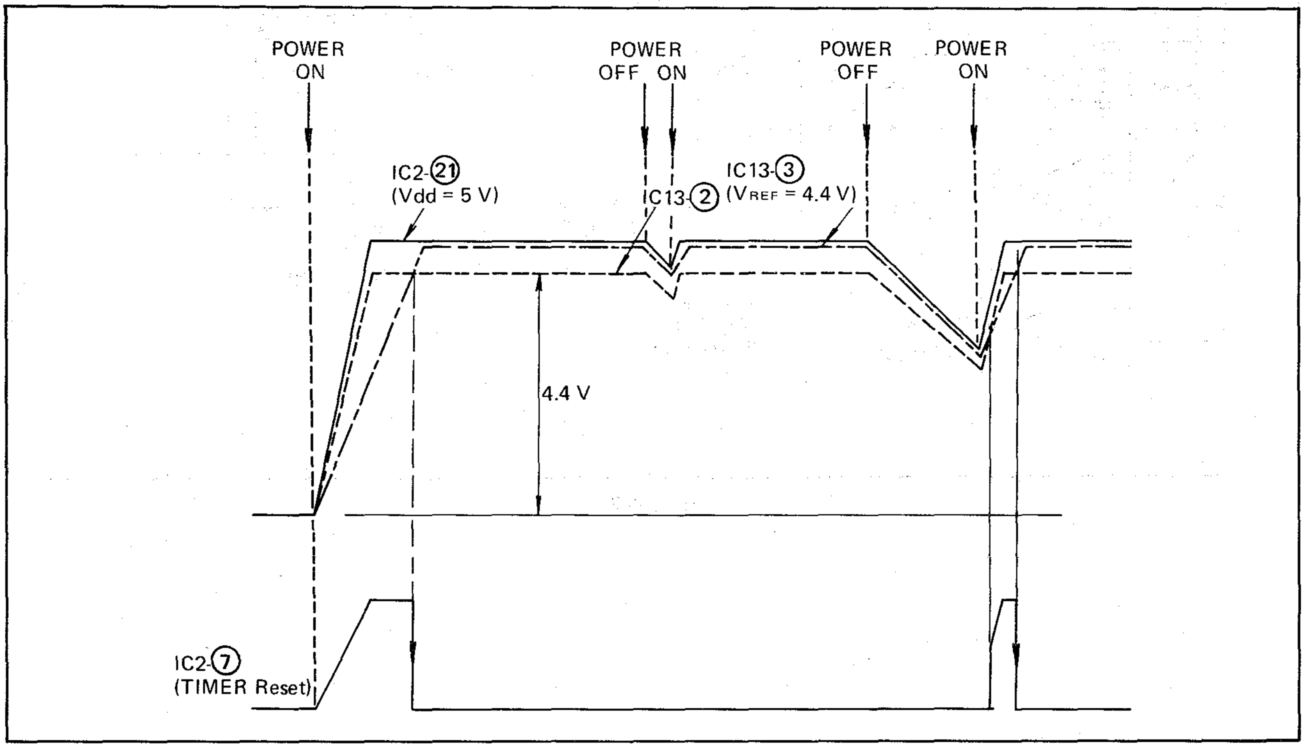

POWER
ON
POWER
OFF ON
POWER
OFF
POWER
ON
IC2-㉑
(Vdd = 5 V)
IC13-②
IC13-③
(VREF = 4.4 V)
4.4 V
IC2-⑦
(TIMER Reset)

Fig. 3-89 Timer reset pulse generator

3.3.7 Display board

1. Display control circuit

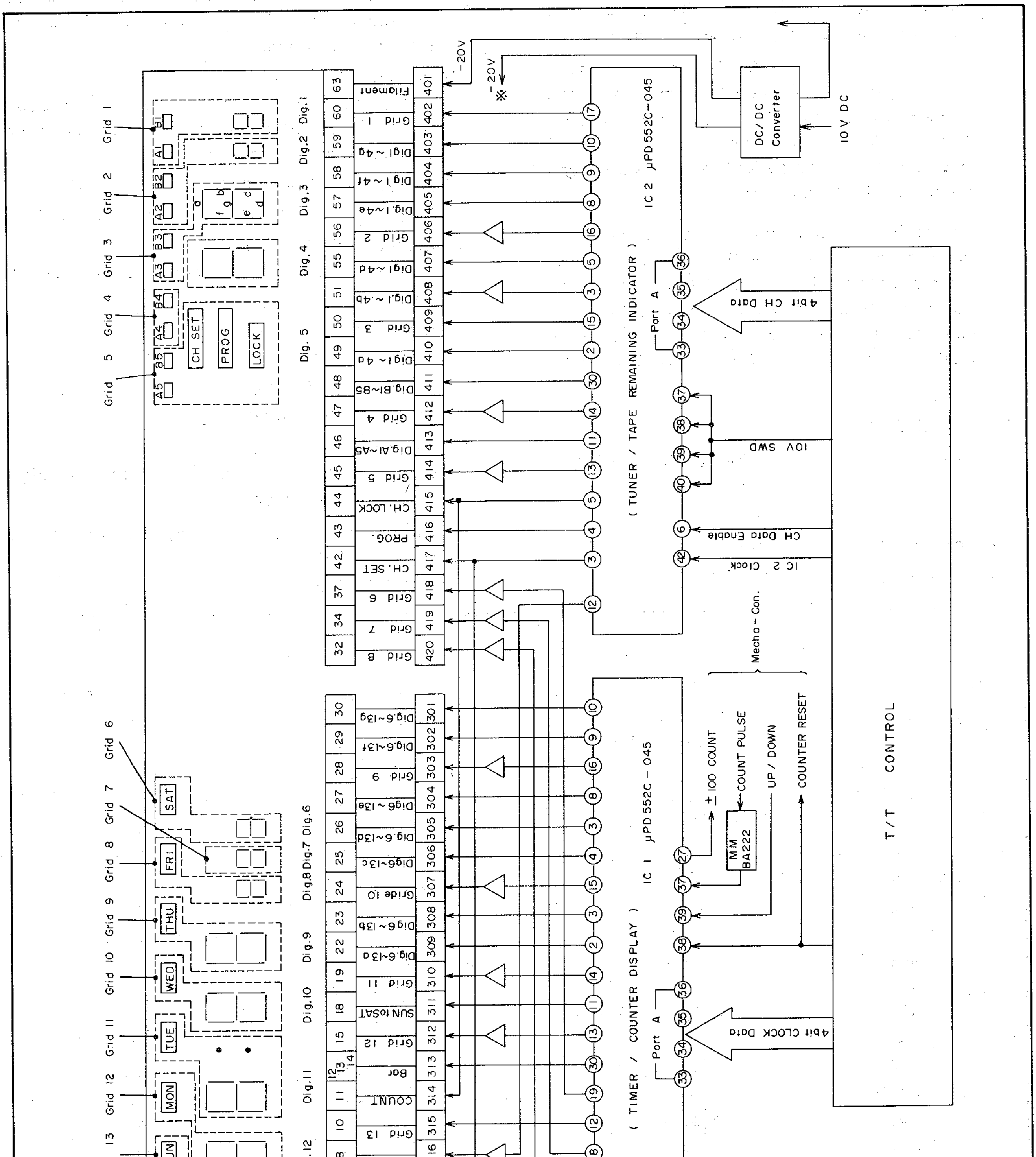

-20V
-20V
※
DC/DC Converter
10 V DC
IC 2 µPD 552C-045
(TUNER / TAPE REMAINING INDICATOR)
Port A
4bit CH Data
10V SWD
CH Data Enable
IC 2 Clock
Mecha-Con.
± 100 COUNT
COUNT PULSE
UP / DOWN
COUNTER RESET
MM BA222
IC 1 µPD 552C-045
(TIMER / COUNTER DISPLAY)
4bit CLOCK Data
T/T CONTROL
Filament
Grid 1
Dig.1~4g
Dig.1~4f
Dig.1~4e
Grid 2
Dig.1~4d
Dig.1~4b
Grid 3
Dig.1~4a
Dig.B1~B5
Grid 4
Dig.A1~A5
Grid 5
CH.LOCK
PROG.
CH.SET
Grid 6
Grid 7
Grid 8
Dig.6~13g
Dig.6~13f
Grid 9
Dig.6~13e
Dig.6~13d
Dig.6~13c
Grid 10
Dig.6~13b
Dig.6~13a
Grid 11
SUN to SAT
Grid 12
Bar
COUNT
Grid 13
Grid 14
CLOCK
2nd
1st
Filament
Grid 1
Grid 2
Grid 3
Grid 4
Grid 5
Grid 6
Grid 7
Grid 8
Grid 9
Grid 10
Grid 11
Grid 12
Grid 13
Grid 14
Dig.1
Dig.2
Dig.3
Dig.4
Dig.5
Dig.6
Dig.7
Dig.8
Dig.9
Dig.10
Dig.11
Dig.12
Dig.13
Dig.14
CH SET
PROG
LOCK
SAT
FRI
THU
WED
TUE
MON
SUN
1st
2nd
CLOCK
PROG
COUNT
B1
A1
B2
A2
B3
A3
B4
A4
B5
A5

Fig. 3-90

Since the display is multifunctional, the display section uses two μPD552C-045 5 bit mask ROM type microcomputers. IC1 performs clock and counter indication control, while IC2 controls TV program No. and tape indicator displays.

In either case, the μcom RAM is latched by applying 4 bit parallel data and data enable signals. The data are decoded into digit and segment displays. Since the signal input is limited to 4 bit parallel data, and RAM address and its data are handed alternately. See timing chart.

By supplying a pulse input, the tape counter performs count display operation independently of external control. Since these data use the microcomputer RAM, they are not reset by the front panel ON and OFF buttons. However, they are reset by the rear panel MAINS POWER switch.

2. μPD552C-045

1) Device:	P channel MOS 4 bit μcom (mask ROM type) 42 pin package
2) Power supply:	10 V
3) Clock Frequency:	400 kHz

4) Instruction Cycle: Approx. 10 μsec

5) Clock oscillator (pins 1 and 42)
A ceramic filter is connected between these pins to produce 400 kHz oscillation. This is used as the μcom clock pulse.

6) Reset terminal (pin 7)
High at this terminal resets the μcom and operation stops. All output ports become low. The μcom operates when this terminal is low.

7) Port A (pins 33, 34, 35, 36)
4 bit parallel inputs for display address data.

8) Input port Bo (pin 37)
Display selection control; count is displayed when low level.

9) Input port B1 (pin 38)
Count pulse input.

10) Input port B2 (pin 39)
Count zero reset input.

11) Input port B3 (pin 40)
Counter up/down control; count up when high, count down when low.

12) Output ports C (pins 2, 3, 4, 5) and Do to D2 (pins 8, 9, 10)
Segment outputs.

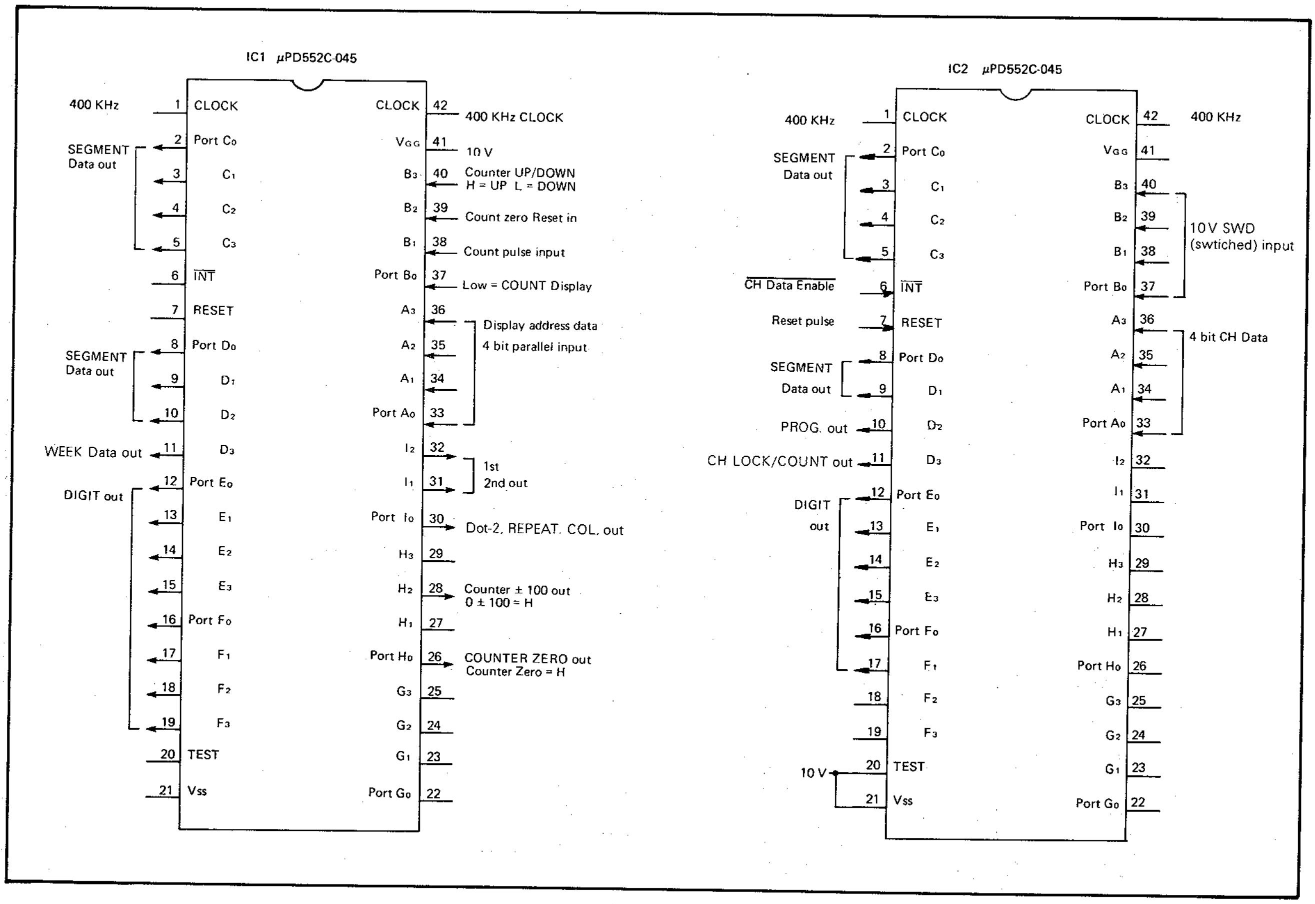

IC1 μPD552C-045
400 KHz
SEGMENT Data out
SEGMENT Data out
WEEK Data out
DIGIT out
CLOCK
Port C0
C1
C2
C3
INT
RESET
Port D0
D1
D2
D3
Port E0
E1
E2
E3
Port F0
F1
F2
F3
TEST
Vss
CLOCK
VGG
B3
B2
B1
Port B0
A3
A2
A1
Port A0
I2
I1
Port I0
H3
H2
H1
Port H0
G3
G2
G1
Port G0
400 KHz CLOCK
10 V
Counter UP/DOWN H = UP L = DOWN
Count zero Reset in
Count pulse input
Low = COUNT Display
Display address data 4 bit parallel input
1st 2nd out
Dot-2, REPEAT, COL, out
Counter ± 100 out 0 ± 100 = H
COUNTER ZERO out Counter Zero = H
IC2 μPD552C-045
400 KHz
SEGMENT Data out
CH Data Enable
Reset pulse
SEGMENT Data out
PROG. out
CH LOCK/COUNT out
DIGIT out
10 V
400 KHz
10V SWD (swtiched) input
4 bit CH Data

Fig. 3-91

13) Output port D_3 (pin 11)
Week (Sun to SAT) display output.

14) Output ports E (pins 12, 13, 14, 15) and F (pins 16, 17, 18, 19)
Digit outputs.

15) Output port H_0 (pin 26)
Counter zero output; high at counter zero.

16) Output port H_2 (pin 28)
Counter ±100 output; output is high when counter is within the range of 0 ±100.

17) Output port I_0 (pin 30)
Repeat and COL output.

18) Output ports I_1 and I_2 (pins 31 and 32)
1st and 2nd display outputs.

3. Dimmer Control

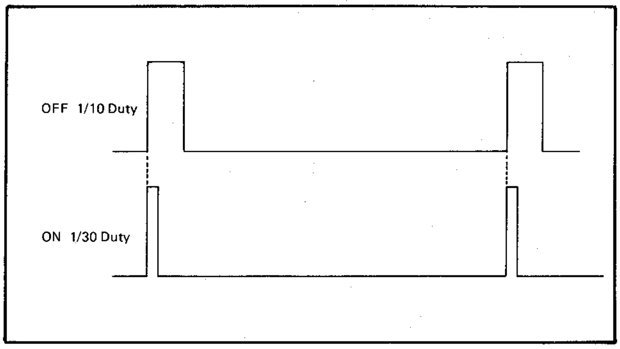


Fig. 3-92 Dimmer contorl

With the DIMMER button on, the digit pulse duty is reduced.

Dimmer off:	1/10 duty
Dimmer on:	1/30 duty

3.3.8 Programmable timer

The programmable timer adopts a 4 bit CMOS LSI microcomputer (μPD650C-049). As already outlined, its functions include 8 programs, recording day (within two weeks), recording channel, recording start time and recording length settings. Timer outputs include recording start (REC OUT) and recording pre-start, which is produced 10 seconds prior to the recording start time.

During pre-start, power is supplied and loading performed to the Pause mode. Recording actually starts after the REC start output is obtained from the timer.

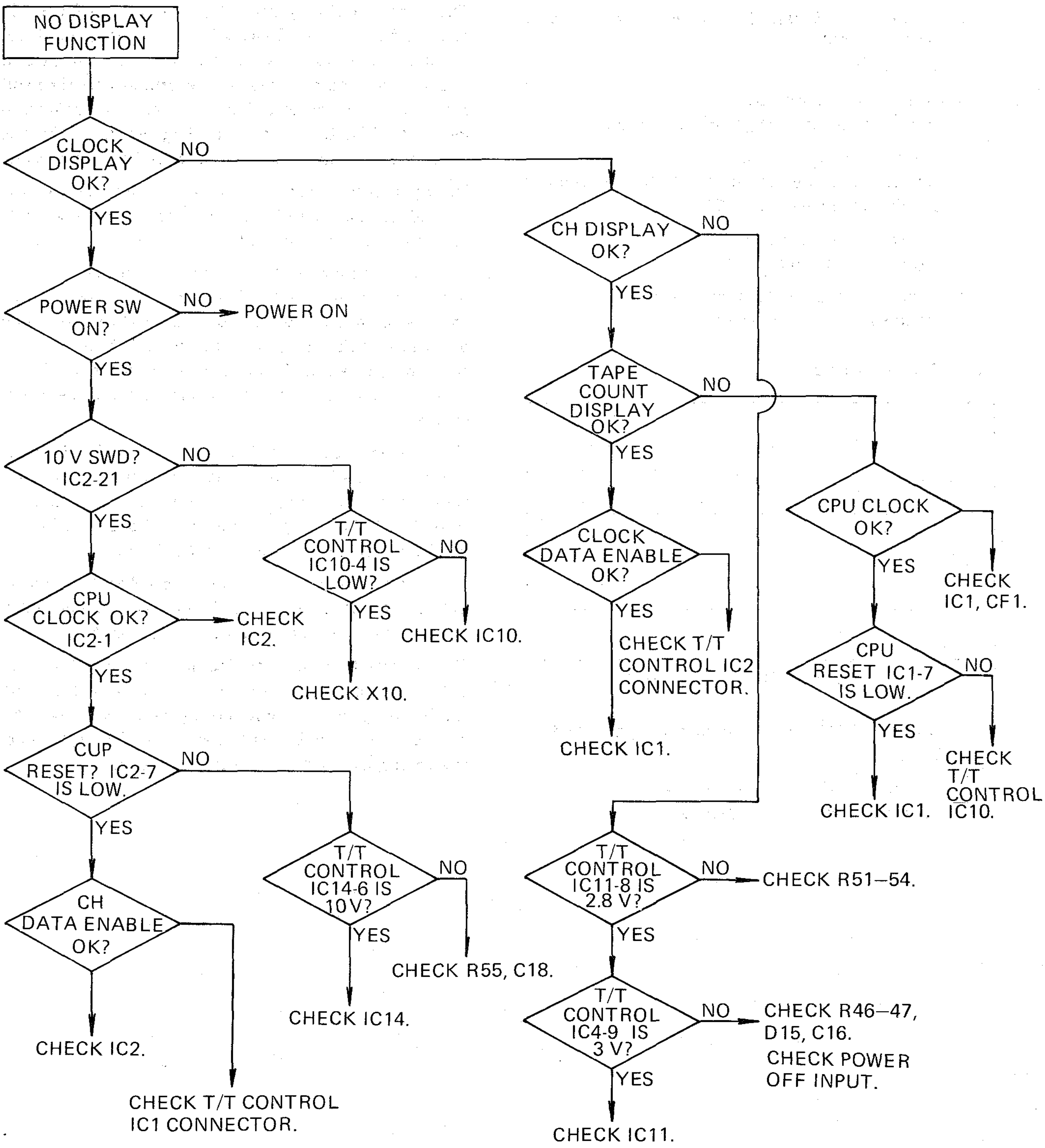
In event of commercial power failure, a nickel-cadmium battery provides about 1 hour back-up. Power supply for the μcom is 5.5 VDC from the regulator. At power on, a reset pulse from IC13 pin 6 to IC1 pin 7 resets IC1. As can be noted from the timing chart, IC13 produces the pulse from the rising component of the power source.

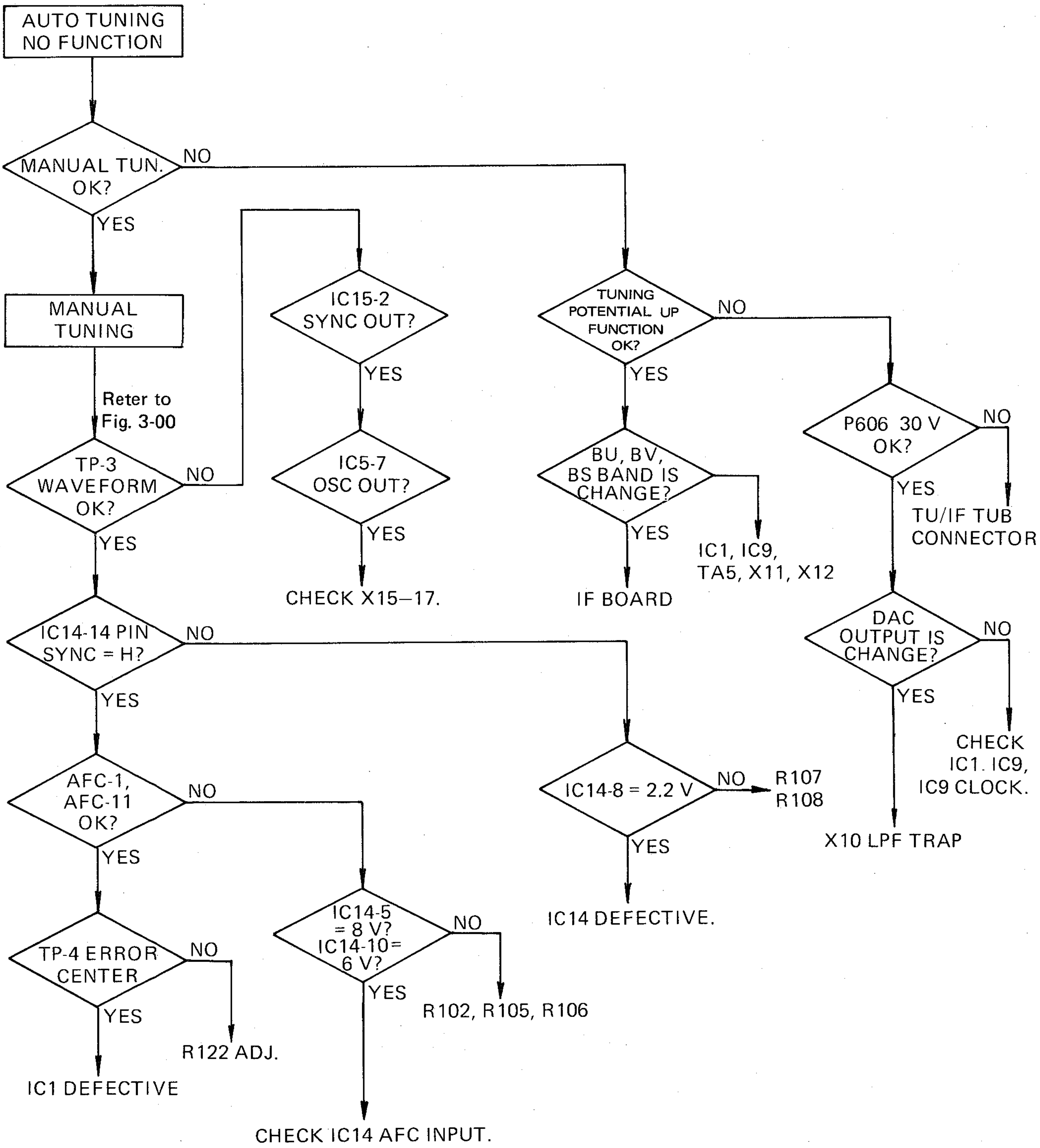
The internal clock of IC1 employs the 400 kHz signal at pins 1 and 42. However, the timer uses a 1 Hz reference signal applied to port A. This reference is produced from 4.194304 MHz generated by IC3 and IC5. In IC3, the frequency is divided 2^{-22} to yield 1 Hz.

Timer setting data are supplied to port B as 4 bit parallel data from IC2 (tuner CPU). These data are controlled by the timer control enable input at IC1 pin 6.

Output data from the timer include 4 bit parallel display data from port G, 4 bit data from port F and port H_3 for TV program no. signal during timer REC, port E_0 pre-start out, port E_1 REC start, port E_2 display data enable out, and port E_3 counter mode out.

3.3.9 TROUBLE SHOOTING GUIDE


NO DISPLAY FUNCTION
CLOCK DISPLAY OK?
NO
YES
POWER SW ON?
NO
POWER ON
YES
10 V SWD? IC2-21
NO
T/T CONTROL IC10-4 IS LOW?
NO
CHECK IC10.
YES
CHECK X10.
YES
CPU CLOCK OK? IC2-1
CHECK IC2.
YES
CUP RESET? IC2-7 IS LOW.
NO
T/T CONTROL IC14-6 IS 10V?
NO
CHECK R55, C18.
YES
CHECK IC14.
YES
CH DATA ENABLE OK?
CHECK IC2.
CHECK T/T CONTROL IC1 CONNECTOR.
CH DISPLAY OK?
NO
YES
TAPE COUNT DISPLAY OK?
NO
YES
CLOCK DATA ENABLE OK?
YES
CHECK T/T CONTROL IC2 CONNECTOR.
CHECK IC1.
CPU CLOCK OK?
CHECK IC1, CF1.
YES
CPU RESET IC1-7 IS LOW.
NO
CHECK T/T CONTROL IC10.
YES
CHECK IC1.
T/T CONTROL IC11-8 IS 2.8 V?
NO
CHECK R51–54.
YES
T/T CONTROL IC4-9 IS 3 V?
NO
CHECK R46–47, D15, C16.
CHECK POWER OFF INPUT.
YES
CHECK IC11.


AUTO TUNING NO FUNCTION
MANUAL TUN. OK?
NO
YES
MANUAL TUNING
Reter to Fig. 3-00
TP-3 WAVEFORM OK?
NO
YES
IC15-2 SYNC OUT?
YES
IC5-7 OSC OUT?
YES
CHECK X15–17.
TUNING POTENTIAL UP FUNCTION OK?
NO
YES
BU, BV, BS BAND IS CHANGE?
YES
IF BOARD
IC1, IC9, TA5, X11, X12
P606 30 V OK?
NO
YES
TU/IF TUB CONNECTOR
DAC OUTPUT IS CHANGE?
NO
YES
CHECK IC1. IC9, IC9 CLOCK.
X10 LPF TRAP
IC14-14 PIN SYNC = H?
NO
YES
IC14-8 = 2.2 V
NO
R107 R108
YES
IC14 DEFECTIVE.
AFC-1, AFC-11 OK?
NO
YES
IC14-5 = 8 V? IC14-10= 6 V?
NO
R102, R105, R106
YES
CHECK IC14 AFC INPUT.
TP-4 ERROR CENTER
NO
R122 ADJ.
YES
IC1 DEFECTIVE

SECTION 4
DISASSEMBLY

4.1 EXTERNAL COVERS

1. Take out screws①and remove the top cover.

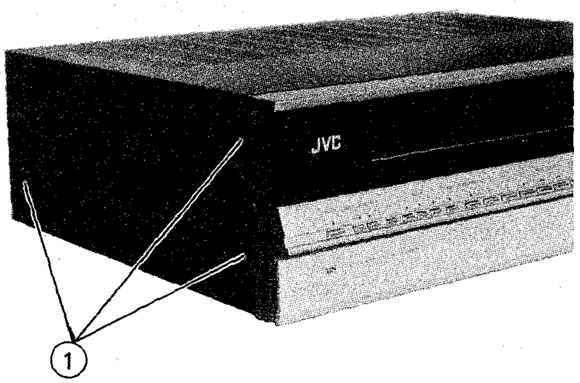


Fig. 4-1(a)

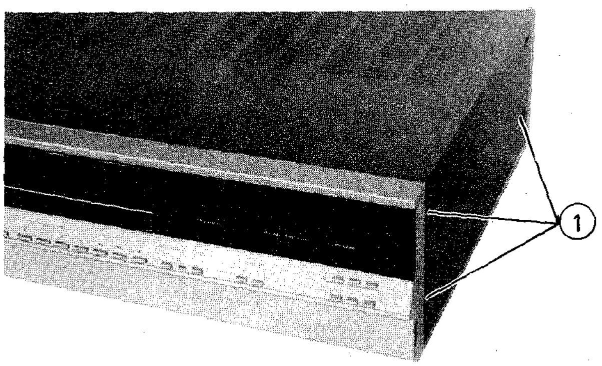


Fig. 4-1(b)

2. Take out screws ② and remove the feet and bottom cover.

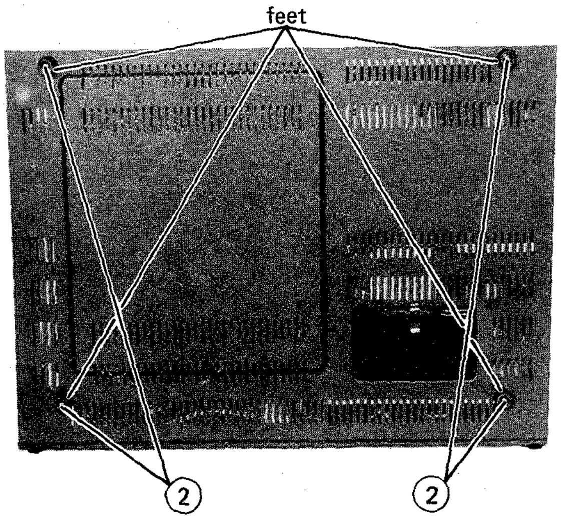


Fig. 4-2

3. Take out screws③and remove the rear cover. Use care regarding the V lock adjustment knob.

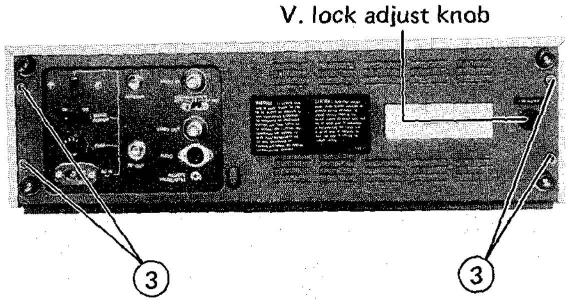

V. lock adjust knob
③
③

Fig. 4-3

4. Open the sub-panel cover and remove the TRACKING knobs.

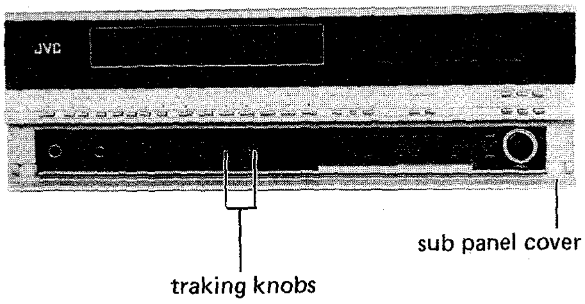

JVC
sub panel cover
traking knobs

Fig. 4-4(a)

5. Take out screws④and remove the front panel.

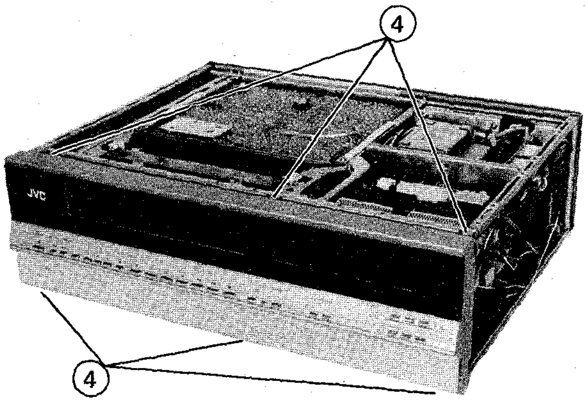


Fig. 4-4(b)

4.2 CIRCUIT BOARD ASSEMBLIES

4.2.1 Y/C board assembly

1. Take out screws ⑤ and raise the Y/C board assembly on edge.
2. Remove the shield cover.
3. Disengage the connectors and remove the board assembly.

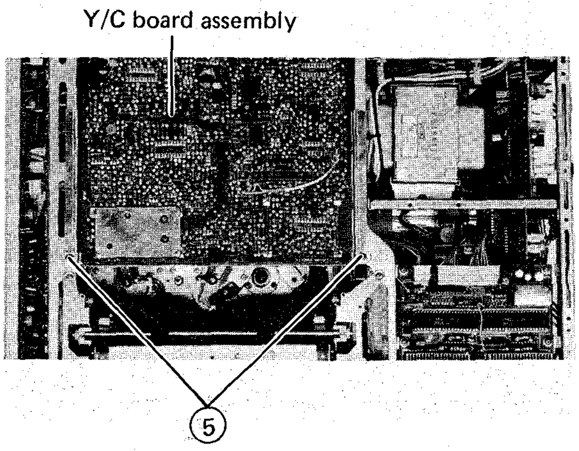

Y/C board assembly
⑤

Fig. 4-5

4.2.2 Servo board assemblies

1. Take out screws ⑥ to free the Servo-1 board assembly.
2. Disengage the connectors and remove the board assembly.

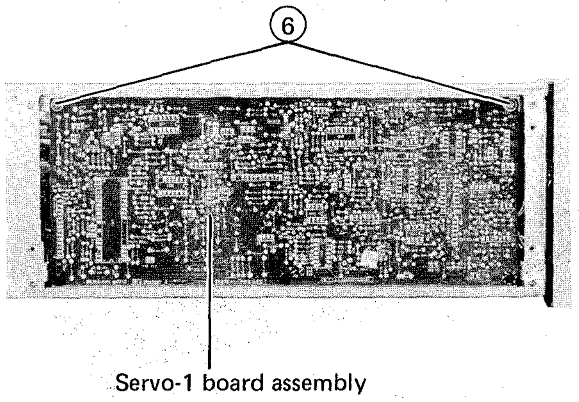

⑥
Servo-1 board assembly

Fig. 4-6(a)

3. Take out screws ⑦ and raise the Servo-2 board assembly to disengage it from the holders.
4. Disengage the connectors and remove the board assembly.

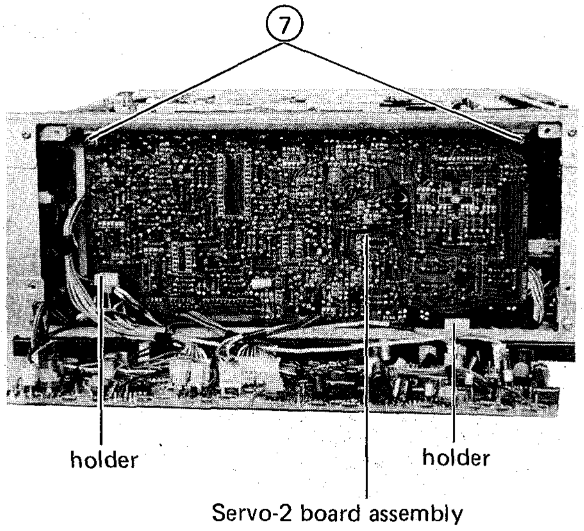

⑦
holder
holder
Servo-2 board assembly

Fig. 4-6(b)

4.2.3 Audio board assembly

1. Take out screws ⑧ to free the Audio board assembly.
2. Disengage the connectors and remove the board assembly.

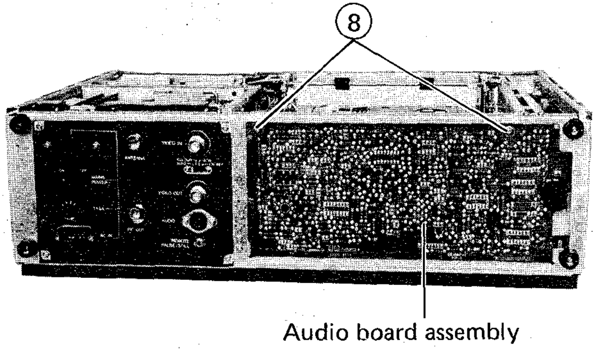

⑧
Audio board assembly

Fig. 4-7

4.2.4 Pre/Rec board assembly

1. First take out screws ⑤ and ⑧ to free the Y/C board assembly and the Audio board assembly.
2. Take out screws ⑨, disengage the connectors and remove the board assembly. Note connections with the connector board.

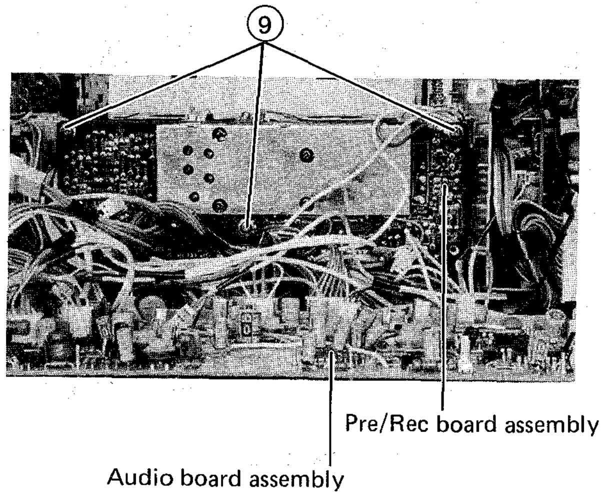

⑨
Pre/Rec board assembly
Audio board assembly

Fig. 4-8

4.2.5 Junction board assembly

1. First take out screws ⑤ to free the Y/C board assembly.
2. Take out screws ⑩ and pull the Junction board assembly upwards.
3. Disengage the connectors and remove the board assembly.

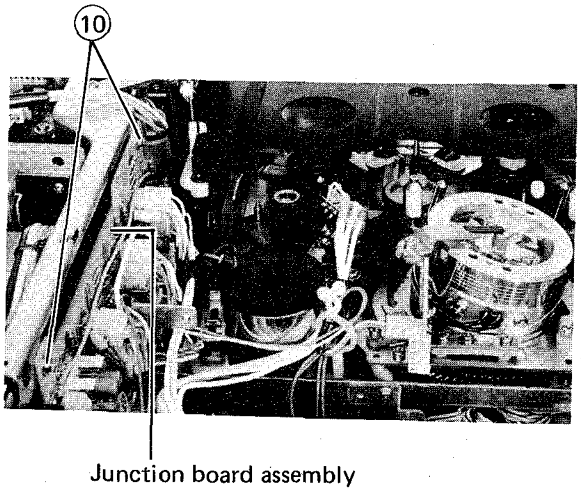

⑩
Junction board assembly

Fig. 4-9

4.2.6 Mechanism control board assembly

1. Take out screws ⑪ to free the Mecha-con board assembly.
2. Disengage the connectors and remove the board assembly.

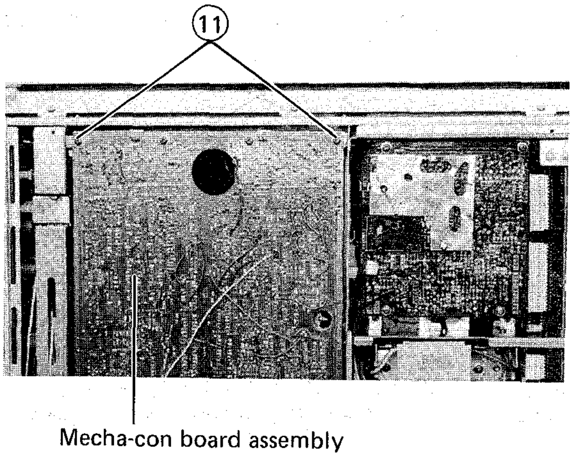

⑪
Mecha-con board assembly

Fig. 4-10

4.2.7 Power supply board assembly

1. Take out screws ⑫ and raise the Power supply board assembly to disengage it from the holders.
2. Disengage the connectors and remove the board assembly.

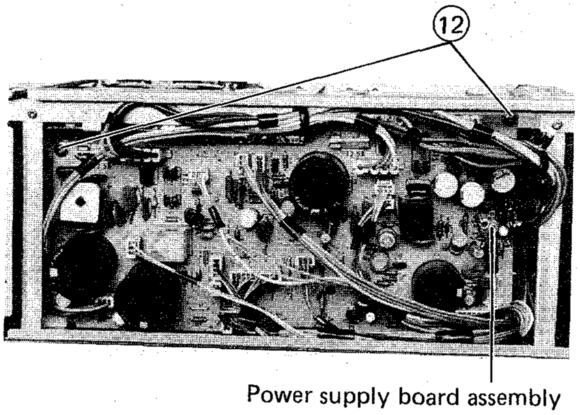

⑫
Power supply board assembly

Fig. 4-11

4.2.8 T/T control board assembly

1. First remove the Power supply board assembly, then take out screws ⑬ .
2. Raise the T/T board assembly to disengage it from the holders.
3. Disengage the connectors and remove the board assembly.

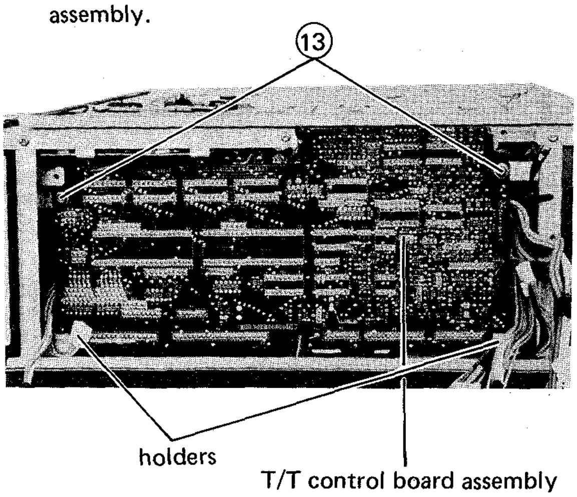

⑬
holders
T/T control board assembly

Fig. 4-12

4.2.9 Display board assembly

1. Take out screws ⑭ and raise the board assembly.
2. Disengage the connectors and remove the board assembly.

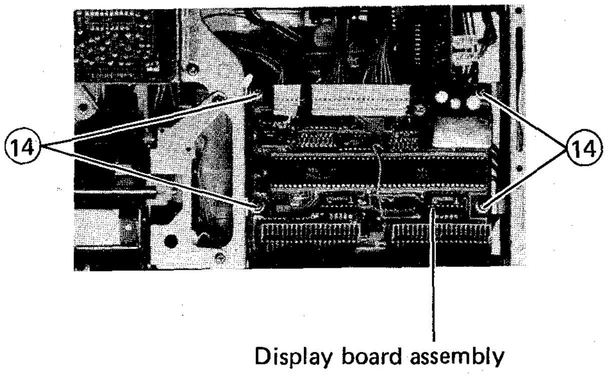

⑭
⑭
Display board assembly

Fig. 4-13

4.2.10 Tuner IF board assembly

1. Take out screws ⑮ and raise the board assembly.
2. Disengage the connectors and rivets to remove the board assembly.

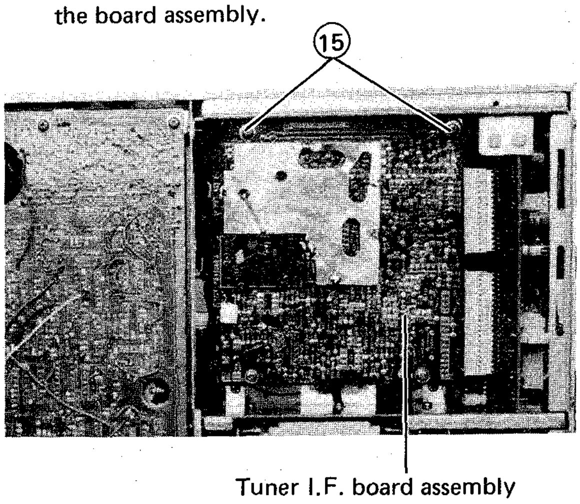

⑮
Tuner I.F. board assembly

Fig. 4-14

SECTION 5
MECHANICAL ADJUSTMENT

5.1 GENERAL

5.1.1 Precautions

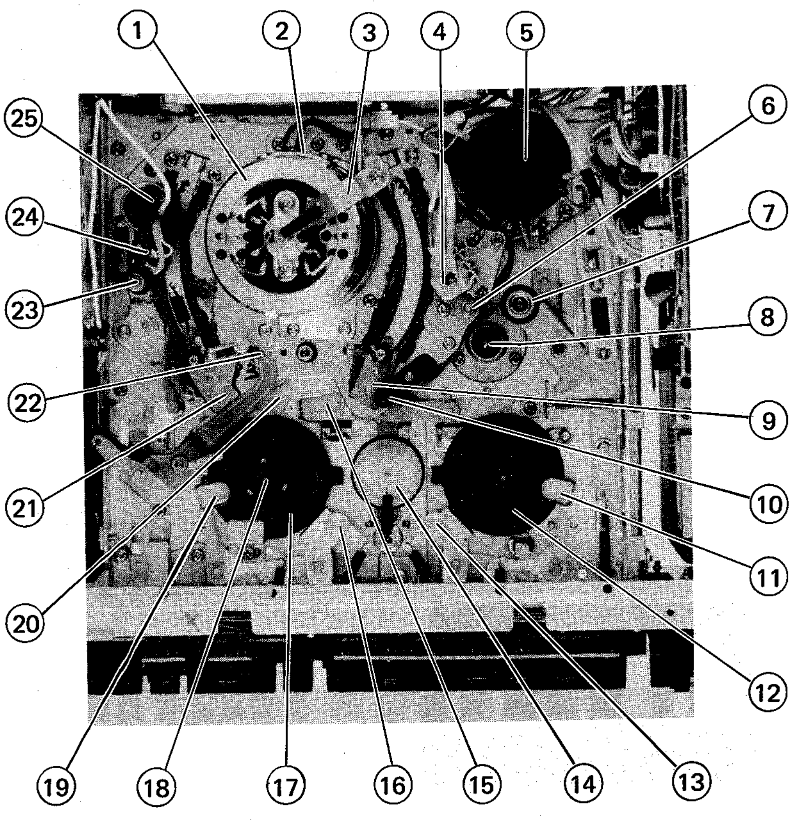
IMPORTANT:

1. *Always turn the power off before removing or soldering components.*
2. *When removing a screw from the chassis, be careful not to drop it into the mechanism. If a screw should be dropped, be sure to retrieve it.*
3. *Be extremely careful not to damage either the upper or lower head drum assemblies.*
4. *The tape transport mechanism has been precisely adjusted at the factory and ordinarily does not require readjustment.*
5. *When removing a part, be very careful not to damage or displace other parts. (Be especially careful with the guide poles and rotary video head drum.)*
6. *To check the mechanism without the cassette housing and tape, lock the cassette switch by using the cassette switch lock jig. Also disable the photo transistor sensors by applying opaque covers.*
   With the cassette housing removed, if the Eject lamp lights and the machine is inoperative, press the front panel OFF button, then the ON button.

NOTE: *After completing checks and repairs, be sure to remove the covers.*

5.1.2 Layout of main mechanical parts

A. Top view and parts identification



1. Upper drum ass'y
2. Heater ass'y
3. Brush ass'y
4. Audio/Control head ass'y
5. Capstan motor ass'y
6. Take up guide pole
7. Pinch roller ass'y
8. Capstan shaft
9. Take-up pole base ass'y
10. Cassette lamp ass'y
11. Take-up tension brake ass'y
12. Take-up reel disk ass'y
13. Take-up main brake ass'y
14. Reel idler ass'y
15. Take-up loading ring ass'y
16. Supply main brake ass'y
17. Tension band ass'y
18. Supply reel disk ass'y
19. Supply tension brake ass'y
20. Supply loading ring ass'y
21. Supply pole base ass'y
22. Tension pole/cue head ass'y
23. Supply guide pole
24. Full erase head
25. Supply impedance roller

Fig. 5-1 (a)

B. Bottom view and parts identification

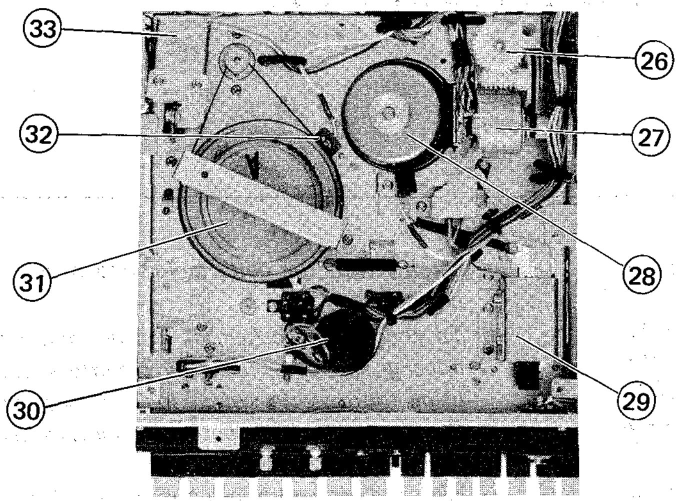


Fig. 5-1 (b)

26. Gear box ass'y
27. Loading motor
28. Lower drum sub ass'y
29. Main solenoid
30. Reel motor ass'y
31. Capstan flywheel ass'y
32. FG board
33. Pinch solenoid

5.1.3 Required jigs and tools

For proper mechanical adjustment, the following jigs and tools are strongly recommended. Without them, a long trial-and-error period would be necessary.

In addition, general-purpose tools and a metric hex key (not supplied by JVC) are required.
The hex key needed for this model is 1.5 mm size.

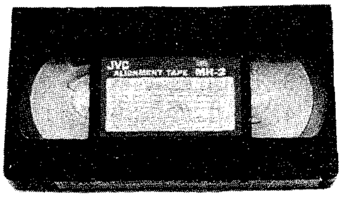
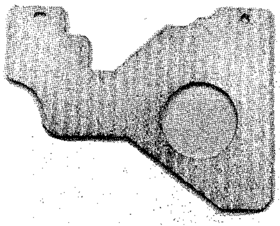
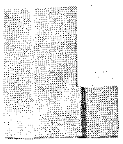
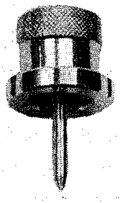
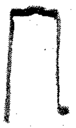
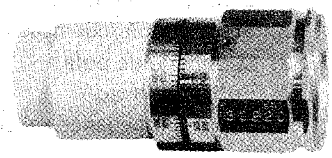
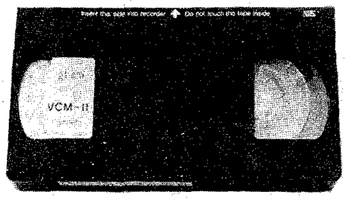
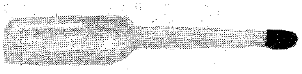
JVC Alignment Tape MH-2 	Master Plane Jig PUJ42146 	Height Gauge PUJ42147 
FG P.W.B Setting Jig PUJ42148 	Cassette Switch Lock Jig PUJ42149 	Thickness Gauge PUJ48017
*Torque Gauge Ass'y PUJ48075-2 Torque meter 600ATG Torque gauge head PUJ48016-2 	Back Tension Cassette Gauge PUJ48076 	JVC Oil PU41761 

Fig. 5-2 Jigs and tools

5.2 PERIODIC MAINTENANCE

The following procedures are recommended for maintaining optimum performance and reliability of this video cassette recorder.

5.2.1 Cleaning

For cleaning, use a lint-free cloth or gauze dampened with alcohol.

A: Tape transport system

1. The following components should be cleaned after every 500 hours of use.
    1) Supply guide pin
    2) Tension pole/cue head
    3) Supply guide pole
    4) Full erase head
    5) Supply impedance roller
    6) Supply guide roller
    7) Supply slant pole
    8) Video head and Drum system
    9) Take up slant pole
    10) Take up guide roller
    11) Audio/control head and Audio erase head
    12) Take up guide pole
    13) Pinch roller
    14) Capstan shaft
2. Since above parts come in direct contact with video tape, they tend to collect dust particles. If allowed to accumulate, dust may lead to damage to the video tape and above parts.
3. After cleaning with alcohol, allow the parts to dry thoroughly before using a cassette tape.

NOTE:

When cleaning the two video heads on the upper drum, do not clean them with a vertical stroke.
Use only a gentle back and forth motion in the direction of the tape path.
Use care since they are easily damaged.
When cleaning video heads, A/C head, cue head and erase heads, use a lint-free cloth dampened with alcohol.

B: Belt/Rubber tire drive system

1. The following components should be cleaned after every 1 000 hours of use.

    – Upper section –

    15) Reel motor
    16) Reel idler
    17) Supply reel disk
    18) Supply main brake
    19) Take up reel disk
    20) Take up main brake
    21) Cassette motor pulley
    22) Cassette gear pulley
    23) Brush ass'y
    24) Commutator

    – Bottom section –

    25) Capstan motor pulley
    26) Capstan belt
    27) Capstan flywheel
    28) Loading belt
    29) Loading motor pulley
    30) Loading gear pulley
2. The above revolving parts are of rubber or come in direct contact with rubber parts. Rubber dust can accumulate and interfere with proper operation.
3. Avoid using excessive alcohol when cleaning rubber parts.

5.2.2 Lubrication

The following components should be lubricated with JVC oil after every 2 000 hours of use.

1) Shaft of the take up reel disk
2) Shaft of the supply reel disk

After cleaning above shafts with alcohol, lubricate these shafts with one or two drops of JVC oil.
Do not over lubricate.

5.2.3 Standard replacement periods for main components

The following chart lists the parts of the units which should receive periodic replacements, together with the recommended intervals.

Name	Replacement Hours					Parts No.
	1 000	2 000	3 000	4 000	5 000	
Upper drum ass'y	●	●	●	●	●	PU31332F-11
Cassette motor ass'y	●	●	●	●	●	PU49158A
Cassette belt	●	●	●	●	●	PU48941
Roller ass'y (for cassette housing)	●	●	●	●	●	PU49042
Reel motor ass'y		●		●		PU48922V (or S, M, P)
Capstan motor		●		●		PU49162S (or M, P)
Capstan belt		●		●		PU49164
Loading belt		●		●		PU48941-2
Reel Idler ass'y		●		●		PU48967A
Tension band ass'y		●		●		PU48899A
Brush ass'y		●		●		PU48678A
Commutator		●		●		PU49483
Take up tension brake		●		●		PU48965B
Supply tension brake		●		●		PU48965A
Audio/Control head sub ass'y			●			PU49556M (or T)
Pinch roller ass'y			●			PU49549A
Loading motor			●			PU48854
Supply reel disk ass'y			●			PU48907A
Take up reel disk ass'y			●			PU48907B
Cue head ass'y					●	PU49654
Full erase head					●	PU47863

Table 5-1 Standard replacement periods for main components

5.2.4 Note

Even if the unit is not used for a long time, Cleaning, Lubrication and Replacement of the belts should be performed every 2 years.

5.3 MAIN ASSEMBLY REPLACEMENTS

5.3.1 Cassette housing assembly and housing motor

1. Cover the tape end sensor with opaque material.
2. Supply power and turn the rubber rollers of the cassette housing assembly by hand in the loading direction to start the housing motor.
3. Press in the raised portion of the cassette housing slide plate to lower the cassette housing. When the Stop mode is reached, disengage the connector.
4. Note the position of the REC safety lever, take out screws Ⓐ and remove the cassette housing assembly as shown in Fig. 5-3.

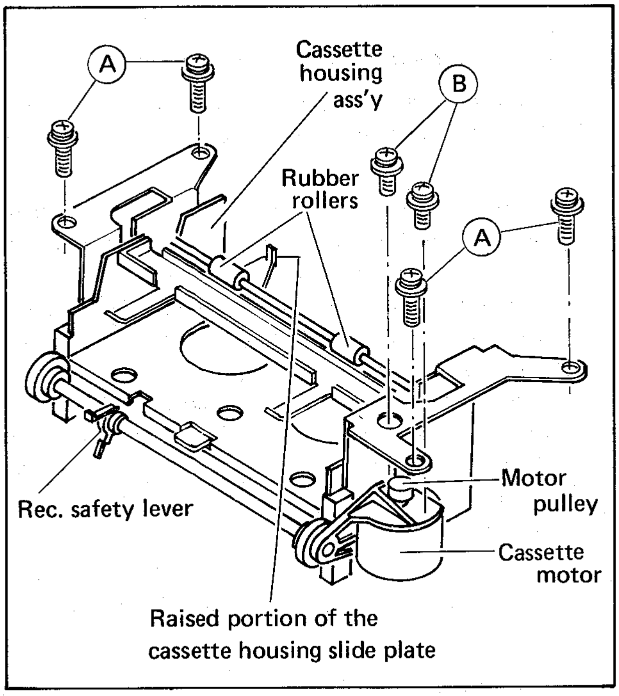

Ⓐ
Cassette housing ass'y
Ⓑ
Rubber rollers
Ⓐ
Rec. safety lever
Motor pulley
Cassette motor
Raised portion of the cassette housing slide plate

Fig. 5-3 Cassette housing replacement

5. Unsolder the cassette motor wires.
6. Disengage the belt from the motor pulley, take out screws Ⓑ and remove the cassette motor. See Fig. 5-4.

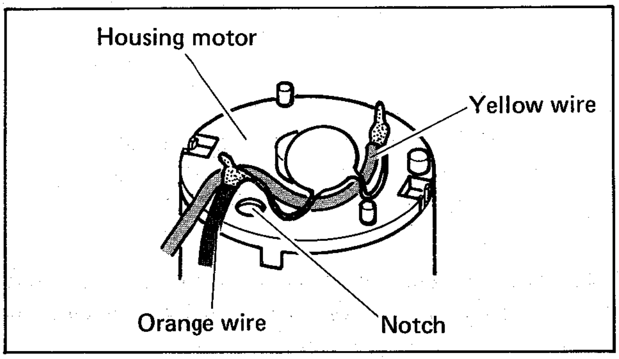

Housing motor
Yellow wire
Orange wire
Notch

Fig. 5-4 Cassette motor replacement

7. Replace the cassette housing assembly (and/or motor assembly) and reassemble by reversing the above steps. Note polarity when resoldering the motor wires. Use care to correctly reinstall the REC safety lever and remove the coverings from the tape end sensor.
8. Use self-recording tape and check for smooth operation of the cassette housing assembly. Confirm operation of the REC safety lever.

5.3.2 Upper drum and brush assemblies/commutator

1. Take out screw Ⓐ and remove the brush assembly. See Fig. 5-5.
2. Remove the commutator from the drum motor shaft.
3. Unsolder the 4 wires coming from the lower drum assembly (perform quickly to avoid damaging the wires).
4. Take out screws Ⓑ and remove the upper drum assembly in the upward direction.
5. Use alcohol to clean the lower face of the new upper drum assembly and the flywheel face of the lower drum assembly. When handling and installing the new upper drum, avoid directly touching the video heads and use care not to scratch the drum.

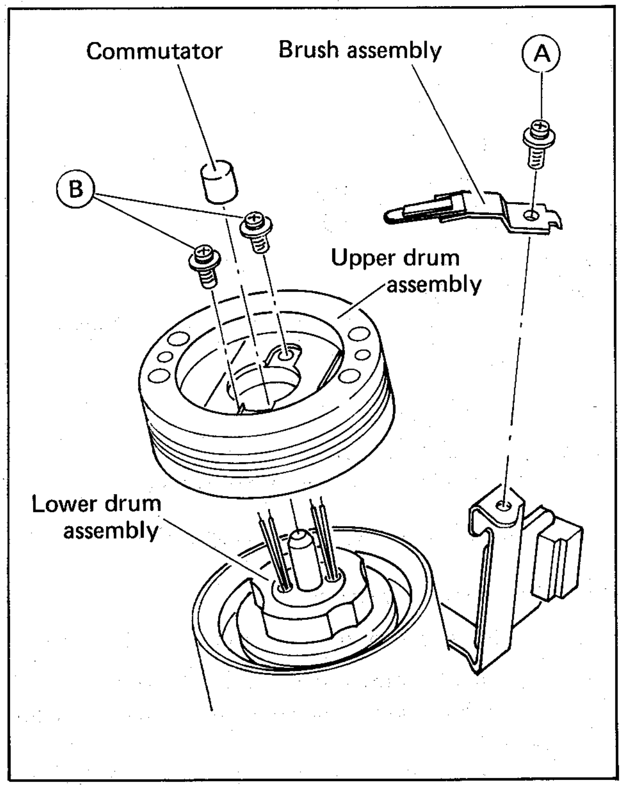

Commutator
Brush assembly
Ⓐ
Ⓑ
Upper drum assembly
Lower drum assembly

Fig. 5-5 Upper drum and brush/commutator replacements

6. Reassemble by reversing the above steps. Observe the correct channels when resoldering the wires (brown: CH-1; red: CH-2). Avoid overheating the wires when resoldering. Observe that the brush assembly contacts the central portion of the commutator.
7. Perform the following checks and adjustments (described in the section 6, electronic adjustments).
   1) Playback switching point (section 6.3.9)
   2) Recording switching point (section 6.3.10)
   3) Tracking preset (section 6.3.12)
   4) Video head resonance and Q (section 6.4.1)
   5) Color playback input level (section 6.6.5)
   6) Overall checks and adjustments of the signal systems.

5.3.3 Audio/control head subassembly

1. Take out screws Ⓐ, Ⓑ and Ⓒ to remove the A/C head subasembly. Use care regarding the coil springs as shown in Fig. 5-6.
2. Remove the A/C head circuit board. Use care not to damage the wires.
3. Replace the A/C head subassembly and reassemble by reversing the above steps.

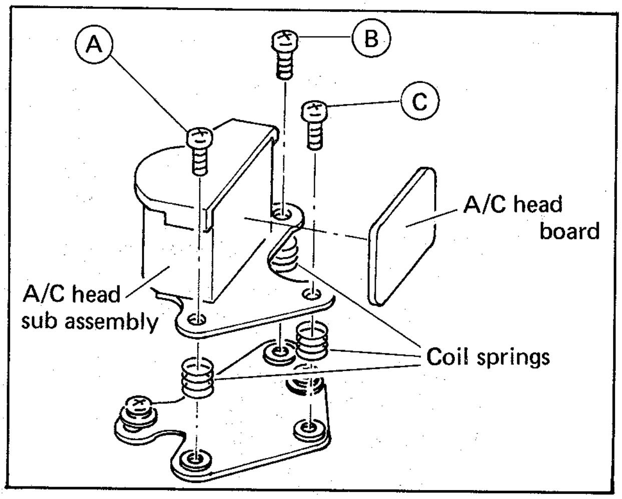


Fig. 5-6 A/C head replacement

4. Perform the following checks and adjustments.

A: Tape transport adjustment

1. Employ self-recording tape and set for Play mode.
2. Turn audio/control head screw Ⓒ (Fig. 5-7) and adjust for smooth transport at the take up guide pole.
   Do not adjust the height of the take up guide pole itself.

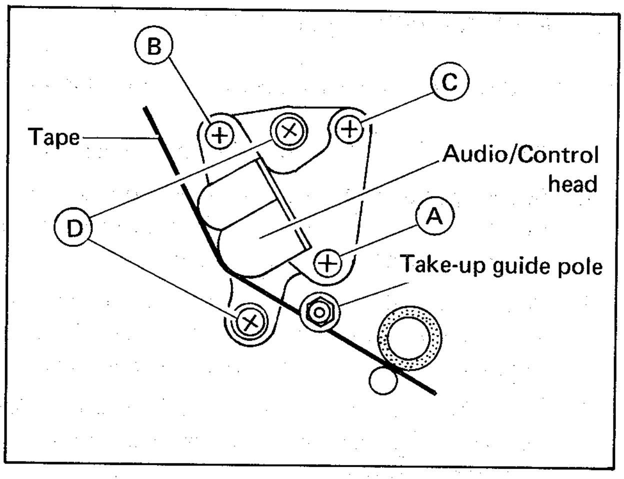


Fig. 5-7 A/C head adjustment-1

B: Audio/control head height and azimuth

1. Connect oscilloscope to Audio TP-2 (Audio out), and play alignment tape (7 kHz and stairstep signals).
2. Turn screws Ⓐ, Ⓑ and Ⓒ (Fig. 5-7) in succession by small and equal increments at a time and adjust for maximum audio output level as shown in Fig. 5-9. With reference to screw Ⓐ, adjust azimuth with screw Ⓑ and adjust screw Ⓒ so that small tape wrinkles at not produced at the guide poles, but at the same time, audio output becomes maximum and level fluctuations minimum. It is suggested to first turn screw Ⓐ by a small amount, then turn screws Ⓑ and Ⓒ by an equal amount and set for maximum output.

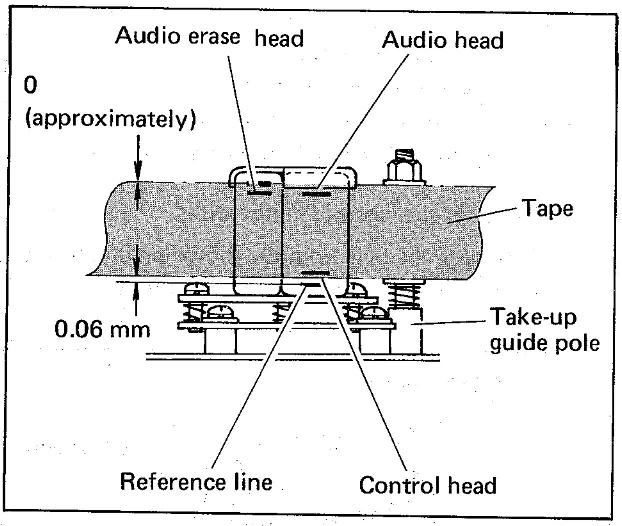


Fig. 5-8 A/C head adjustment-2

3. Carefully and evently adjust screws Ⓐ, Ⓑ and Ⓒ to align the audio/control head height with the tape as shown in Fig. 5-8.

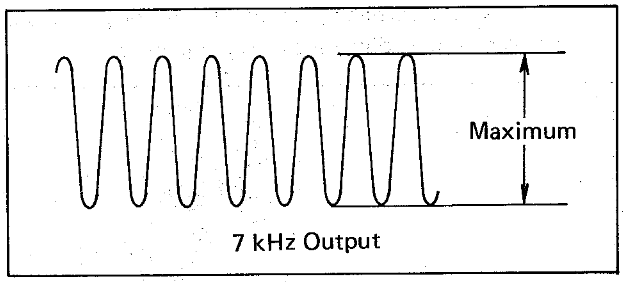


Fig. 5-9 Audio output level

C: Audio/control head inclination

1. Set the height gauge as shown in Fig. 5-10. Check for space t of 0 ± 0.05 mm. If not within this range, adjust according to the above steps.

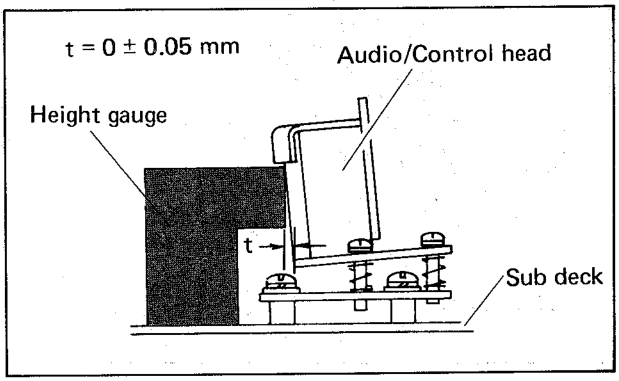


Fig. 5-10 A/C head inclination

D: Final checks/adjustments

Check according to the following steps.

1. Playback control level (see section 6.3.8).
2. Control head phase (see section 6.3.18).
3. Audio recording and playback levels and the audio circuit (see section 6.7).

5.3.4 Lower drum assembly (including motor)

1. For considerations of reliability, the drum motor and lower drum assembly should be replaced simultaneously.
2. Disengage the connector from the lower drum assembly (Drum FG board).
3. Remove the Pre/Rec board (section 4.2.4) and the upper drum assembly (section 5.3.2).
4. Unsolder the wires (except black wires) from the connector board.
5. Disengage the connector from the connector board, take out screws Ⓐ and remove the lower drum assembly as shown in Fig. 5-11.
6. Take out screws Ⓑ and remove the heater from the lower drum assembly.
7. Take out screw Ⓒ, remove the board bracket and replace the lower drum assembly.
8. Reassemble by reversing the above steps. Use care to resolder the connector board wires in their proper positions.

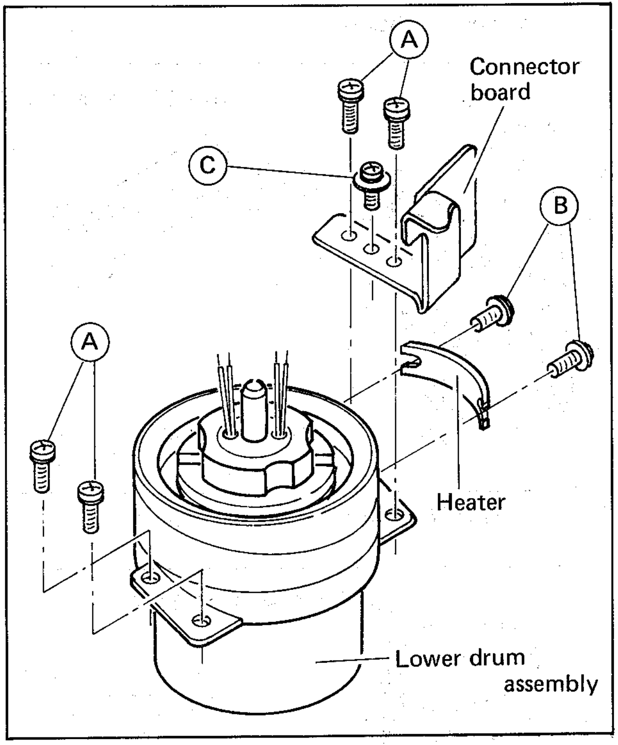


Fig. 5-11 Lower drum replacement

9. Perform the following checks and adjustments.
   1) Drum servo (section 6.3)
   2) Interchangeability (section 5.6)
   3) The checks and adjustments following upper drum assembly replacement (listed in step 7 of section 5.3.2).

5.3.5 Reel motor assembly

1. Before replacing the reel motor, carefully observe its mounting condition (particularly wire polarities, positioning and clamping).
2. Unsolder the motor wires from the feed through capacitor.
3. Turn the loading motor by hand to rotate the loading ring to about half its travel.
4. Remove the plate spring and the spring from the reel idler assembly.
5. Slightly raise the reel idler assembly and shift it to below the cassette lamp.

6. Take out screws Ⓐ and remove the reel motor assembly as shown in Fig. 5-12.
7. Loosen screw Ⓑ, remove the motor band assembly and replaced the reel motor assembly as shown in Fig. 5-13.
8. Reassemble by reversing the above steps. Use care regarding the polarity of the motor wires and that the motor band assembly does not contact other parts or the chassis.

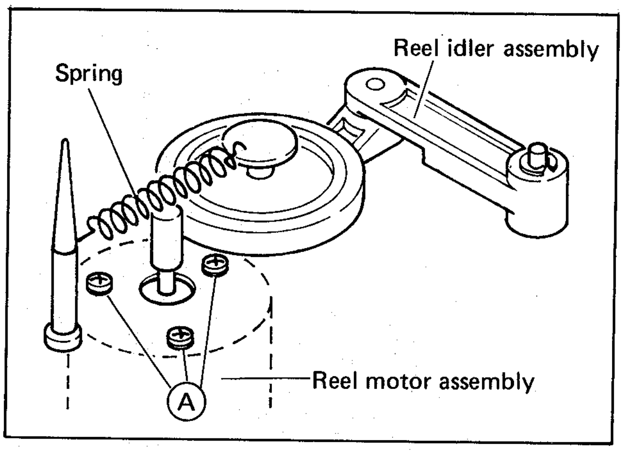

Spring
Reel idler assembly
Reel motor assembly
A

Fig. 5-12 Reel motor replacement-1

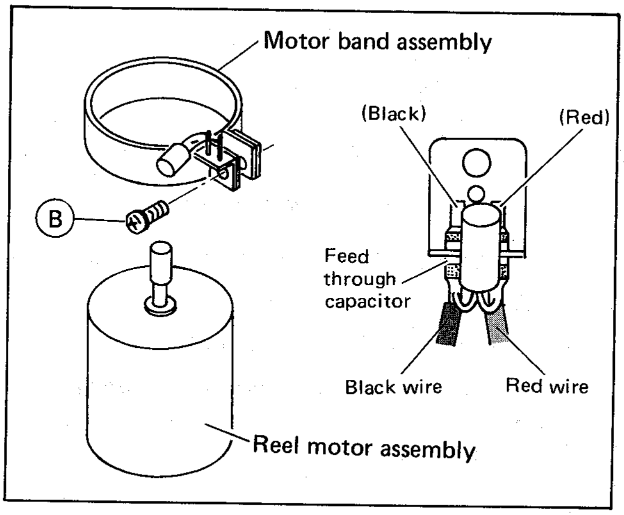

Motor band assembly
B
(Black)
(Red)
Feed through capacitor
Black wire
Red wire
Reel motor assembly

Fig. 5-13 Reel motor replacement-2

9. Perform torque adjustment (section 5.4.6).

5.3.6 Loading motor

1. Before replacing the loading motor, carefully observe its mounting condition (particularly wire polarities, positioning and clamping).
2. Take out screws Ⓐ and remove the gear box assembly as shown in Fig. 5-14.
3. Unsolder the motor wires.
4. Disengage the belt from the pulley, take out screws Ⓑ and remove the loading motor assembly.
5. Loosen the setscrew, remove the motor pulley and replace the loading motor. See Fig. 5-15.

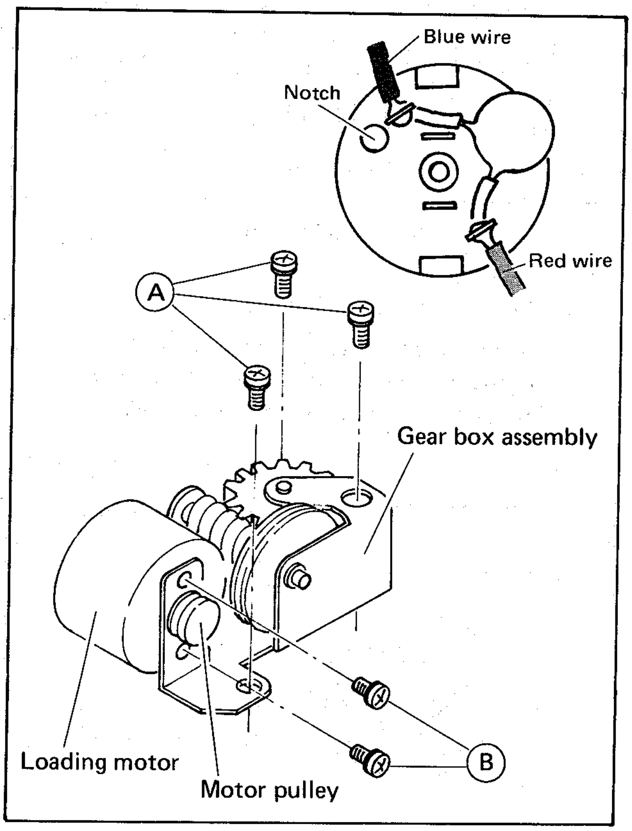

Blue wire
Notch
Red wire
A
Gear box assembly
Loading motor
Motor pulley
B

Fig. 5-14 Gear box assembly

6. Reassembly by reversing the above steps. Use a 0.5 mm thickness gauge to mount the motor pulley. Turn the loading rings by hand to end of travel and install the gear box assembly. Observe that wires are properly clamped and do not contact rotating parts. See Fig. 5-15.

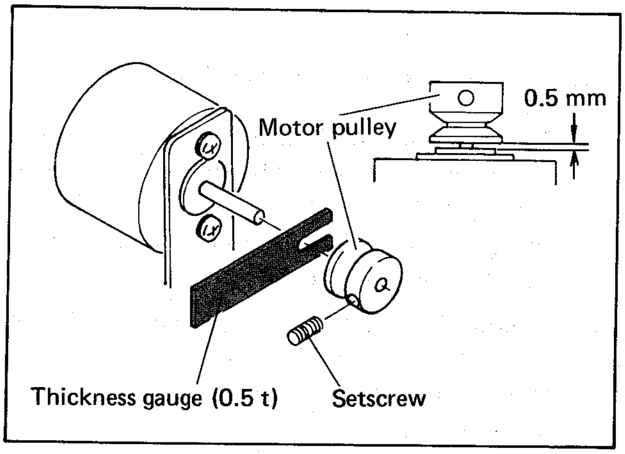

Motor pulley
0.5 mm
Thickness gauge (0.5 t)
Setscrew

Fig. 5-15 Loading motor replacement

5.3.7 Capstan motor assembly

1. Before replacing the capstan motor, carefully observe its mounting condition (particularly wire polarities, positioning and clamping).
2. Unsolder the motor wires from the feed through capacitor.
3. Disengage the belt, take out screws Ⓐ and remove the capstan motor assembly.
4. Loosen screw Ⓑ, remove the motor band assembly.
5. Install the replacement motor assembly by reversing the above steps. Use care that the motor band assembly does not contact other parts or the chassis. See. 5-16.

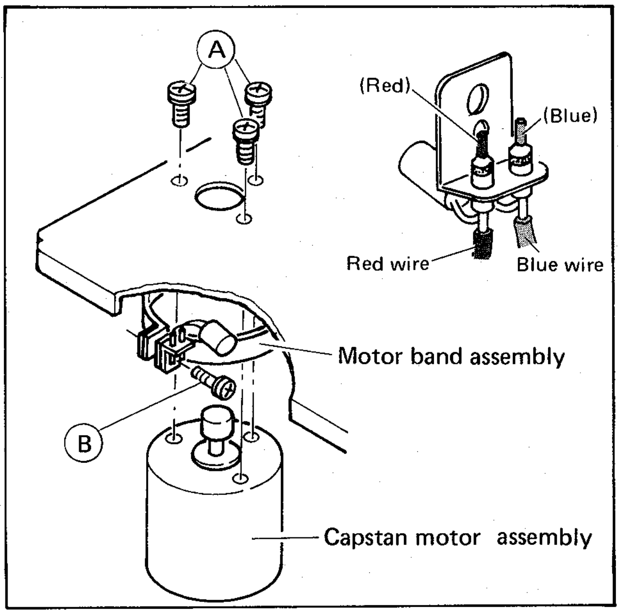


Fig. 5-16 Capstan motor replacement

6. Perform capstan servo circuit adjustments (section 6.3).

5.3.8 Pinch roller solenoid

1. Take out screws Ⓐ and remove the solenoid.
2. Take out screws Ⓑ, remove the solenoid bracket and replace the solenoid (ordinarily, it is not necessary to replace the plunger). See 5-17.
3. Reassemble by reversing the above steps, but do not tighten firmly at this time.
4. Without tape, supply power and set for the Play mode.
5. Adjust the solenoid mounting position for 0.5 mm space between the spring holder and spring. Tighten the solenoid mounting screws firmly (This step adjusts pinch roller pressure.) as shown in Fig. 5-18.

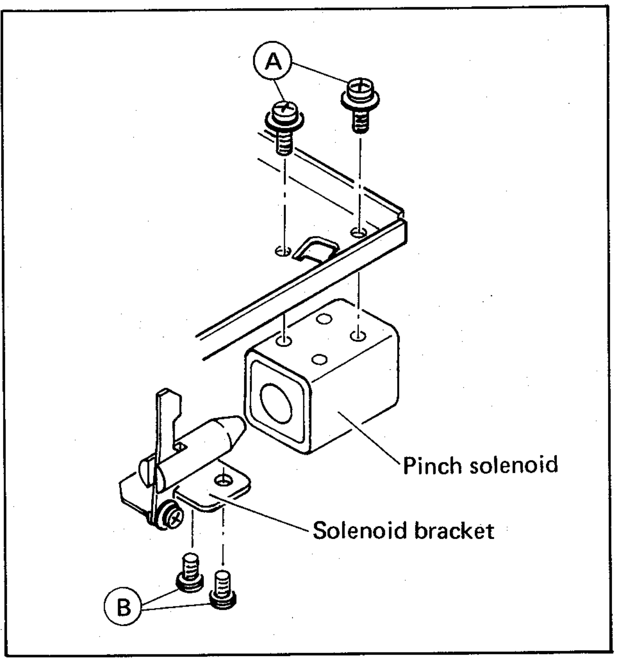


Fig. 5-17 Pinch solenoid replacement

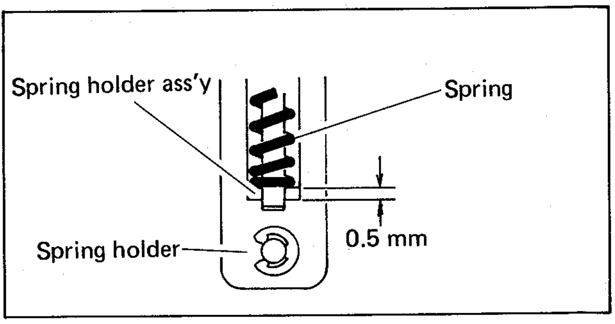


Fig. 5-18 Pinch solenoid adjustment

5.3.9 FG (frequency generator) PWB

1. Take out screws Ⓐ and remove the bracket assembly as shown in Fig. 5-19.

3. Take out screws Ⓑ and remove the FG PWB as shown in Fig. 5-20.

4. Remove the board holder from FG PWB unsolder the wires and replace the FG PWB.

5. Install the new FG PWB by reversing the above steps. Use the FG PWB setting jig to obtain proper positioning as shown in Fig. 5-21. After mounting the capstan flywheel, install the shield cap and clean the capstan shaft thoroughly with alcohol.

6. Perform capstan FG level adjustment (section 6.3.6).

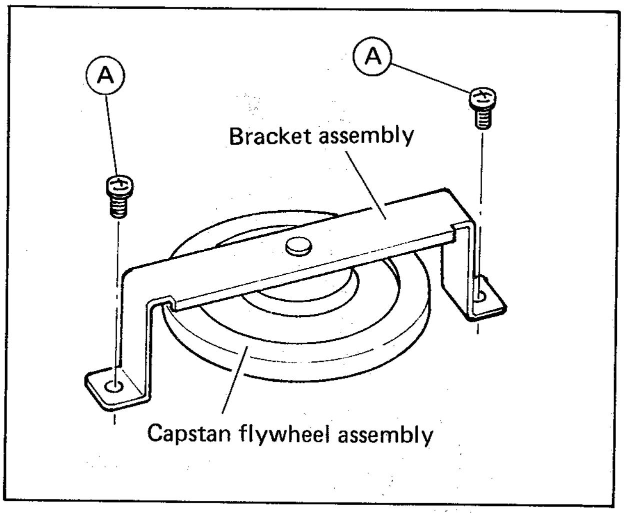

A
A
Bracket assembly
Capstan flywheel assembly

Fig. 5-19 Capstan flywheel replacement

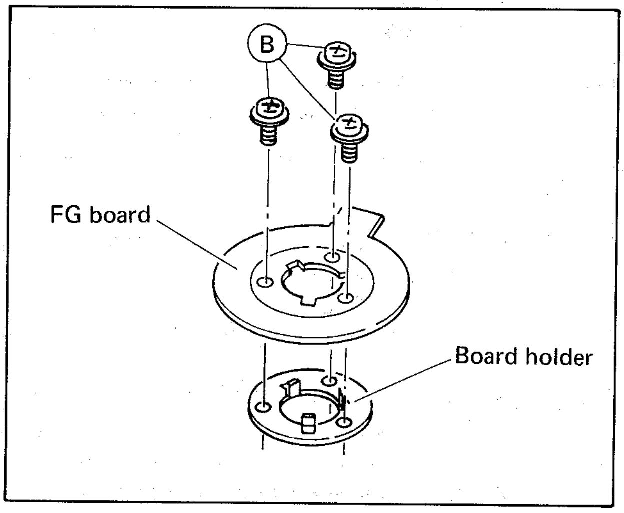

B
FG board
Board holder

Fig. 5-20 FG board replacement

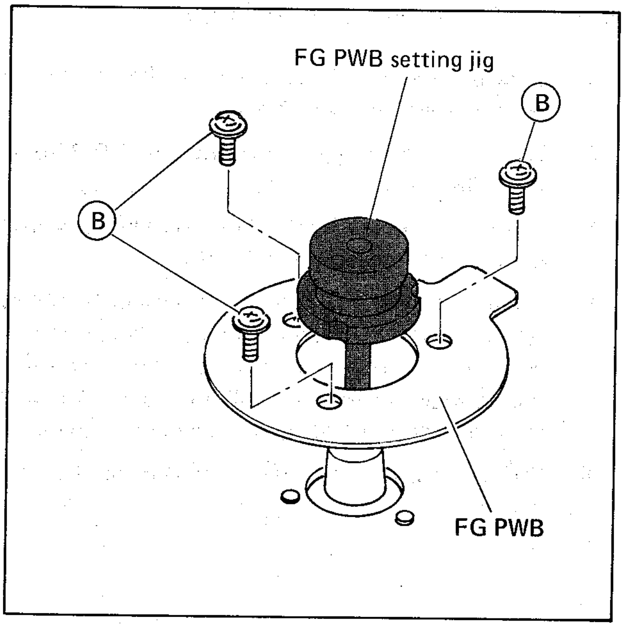

FG PWB setting jig
B
B
FG PWB

Fig. 5-21 FG PWB setting jig

5.4 TAPE TRANSPORT SYSTEM CHECKS AND ADJUSTMENTS

The tape transport system has been precisely aligned at the factory and normally does not require readjustment. The following steps are therefore necessary only in cases of severe usage or when replacing parts affecting the tape transport system.

Before proceeding, remove the cassette housing (see section 5.3.1) and cover the tape start and end sensors with opaque material. Use the cassette switch lock jig to close the cassette switch as shown in Fig. 5-22. Be sure to remove the covers and jig after completing adjustment.

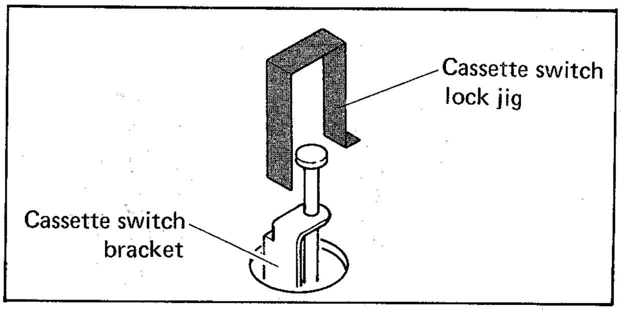

Cassette switch lock jig
Cassette switch bracket

Fig. 5-22 Cassette switch lock jig

5.4.1 Master plane jig setting

1. Be sure to use the master plane jig part number PUJ42146 for this machine.
2. As shown in Fig. 5-23, position the master plane jig with respect to the two pinch roller shafts and the stud.

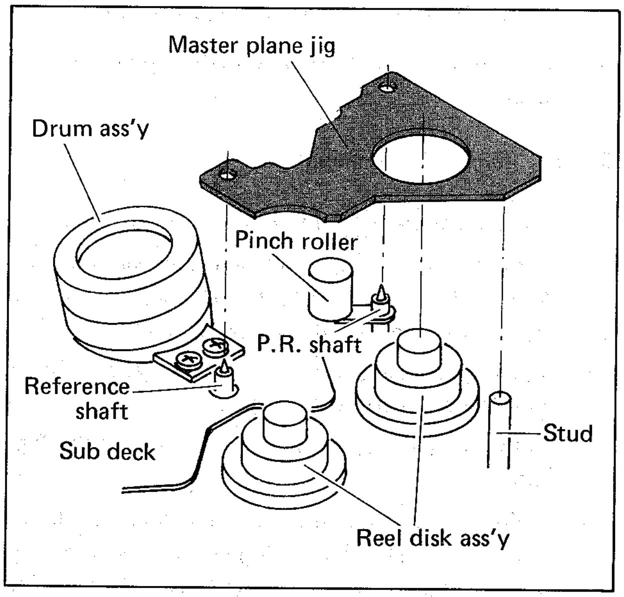

Master plane jig
Drum ass'y
Pinch roller
P.R. shaft
Reference shaft
Sub deck
Stud
Reel disk ass'y

Fig. 5-23 Master plane jig

5.4.2 Reel disk height

1. Set the master plane jig.
2. Use the height gauge (PUJ42147) to check the reel disk assembly height. Measure at 2 places 90° apart. (The earlier reel disk height adjustment jig,
3. The correct height is between planes A and B, as shown in Fig. 5-25. If it is necessary to adjust the height, add or subtract the required number of height adjusting washers.

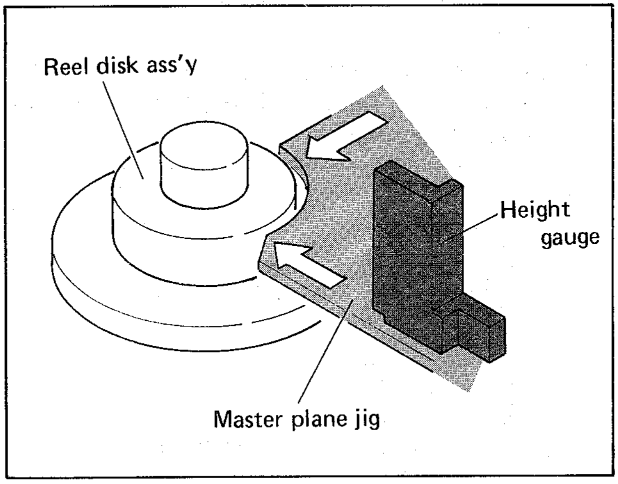

Reel disk ass'y
Height gauge
Master plane jig

Fig. 5-24 Reel disk height adjustment-1

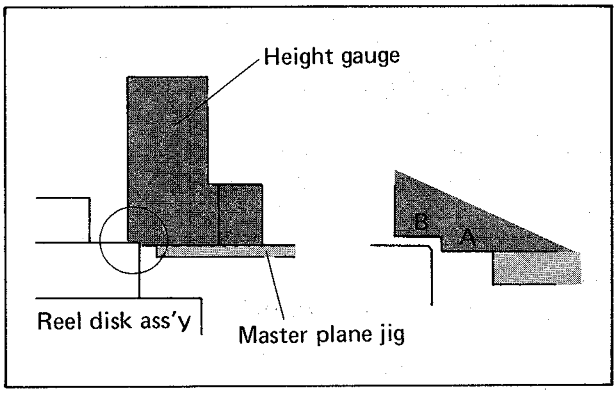

Height gauge
B
A
Reel disk ass'y
Master plane jig

Fig. 5-25 Reel disk height adjustment-2

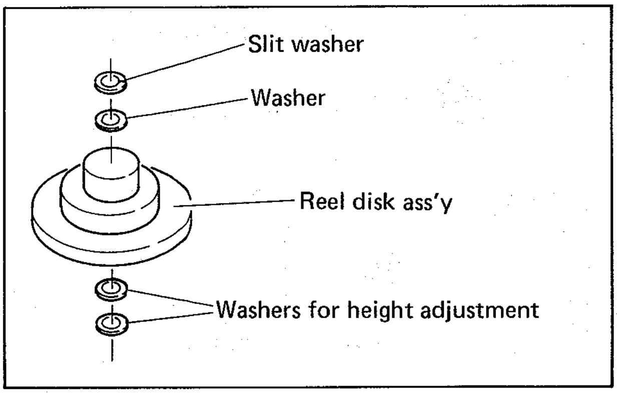

Slit washer
Washer
Reel disk ass'y
Washers for height adjustment

Fig. 5-26 Washers for height adjustment

4. If replacing the reel disk assembly, apply a small amount of oil to the shaft.

5.4.3 Guide poles and full erase head

1. Set the height gauge (PUJ42147) on the sub deck and check the perpendicularity.
2. For each guide pole, check the height of the lower face of the upper flange. If necessary, carefully adjust by turning the nut.
3. If guide pole height has been adjusted, tape transport operation are required (see section 5.5).

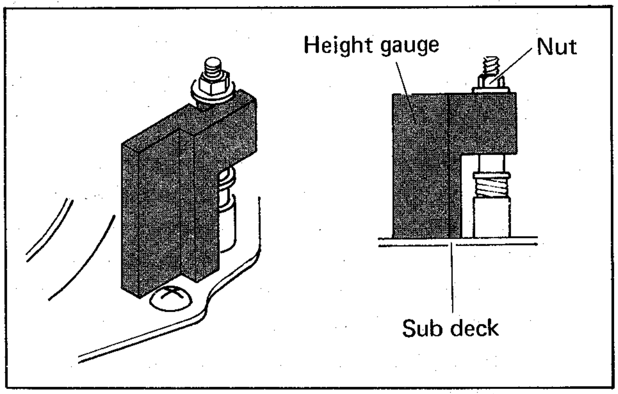

Height gauge
Nut
Sub deck

Fig. 5-27 Guide pole height adjustment

5.4.4 Capstan and pinch roller

1. Set the height gauge on the master plane jig.
2. By hand, press the pinch roller to the point just before it contacts the capstan shaft. Check for parallel between b - b' and c - c'.
3. Without tape, set for the Play mode.
4. Use the height gauge to check that the pinch roller is not inclined in the tape running direction. Check for parallel between c - c' and a - a'. A space at the bottom of within 0.1 mm is acceptable.

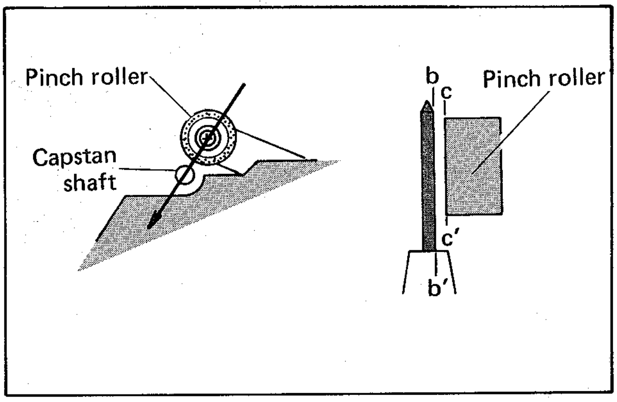

Pinch roller
Capstan shaft
b
c
Pinch roller
c'
b'

Fig. 5-28 Pinch roller parallel-1

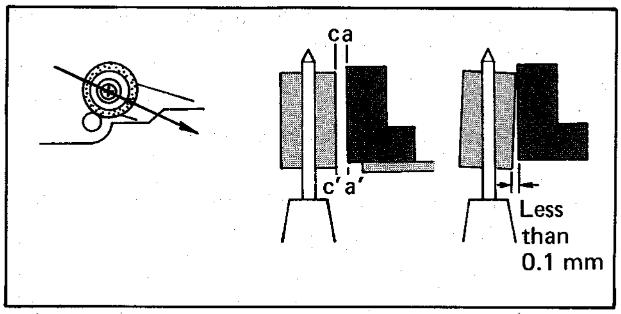

ca
c'a'
Less than 0.1 mm

Fig. 5-29 Pinch roller parallel-2

5.4.5 Tension pole (cue head) and back tension

1. Set the height gauge on the sub deck and check the perpendicularity of the tension pole.
2. At the end portion of 180 minute tape, set for the Play mode.
3. Check that the tension pole is positioned with respect to the sub deck cut out as shown in Fig. 5-30. If necessary, temporarily remove the cassette tape and adjust the mounting position of the tension band bracket. (The cassette tape must be removed for this adjustment.)
4. Use the back tension adjustment jig and set for the Play mode.
5. Adjust the spring hook position to obtain 25 gcm back tension.
6. Again check and adjust the tension pole position using 180 minute tape. Afterwards, use the back tension adjustment jig and confirm 20 to 30 gcm back tension. (The tension pole position must be checked after adjusting the spring hook.)

5.4.6 Take-up torque

1. Use the PUJ48016-2 torque gauge head and set the torque gauge on the take-up reel disk assembly.
2. Relax the grip on the torque gauge so that the indicator needle and scale rotate at equal speeds, then read the indication. The correct value is between 60 and 140 gcm.
3. If the reel motor assembly has been replaced, adjust R1 of the MECHACON board for 100 gcm torque.
4. Run the full length of 180 minute tape in Fast Forward and Rewind modes. Check that tape slackening is absent.

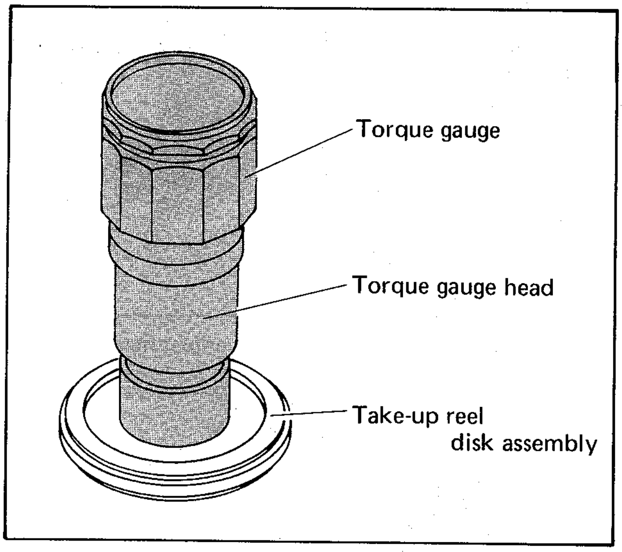

Torque gauge
Torque gauge head
Take-up reel disk assembly

Fig. 5-31 Take-up torque

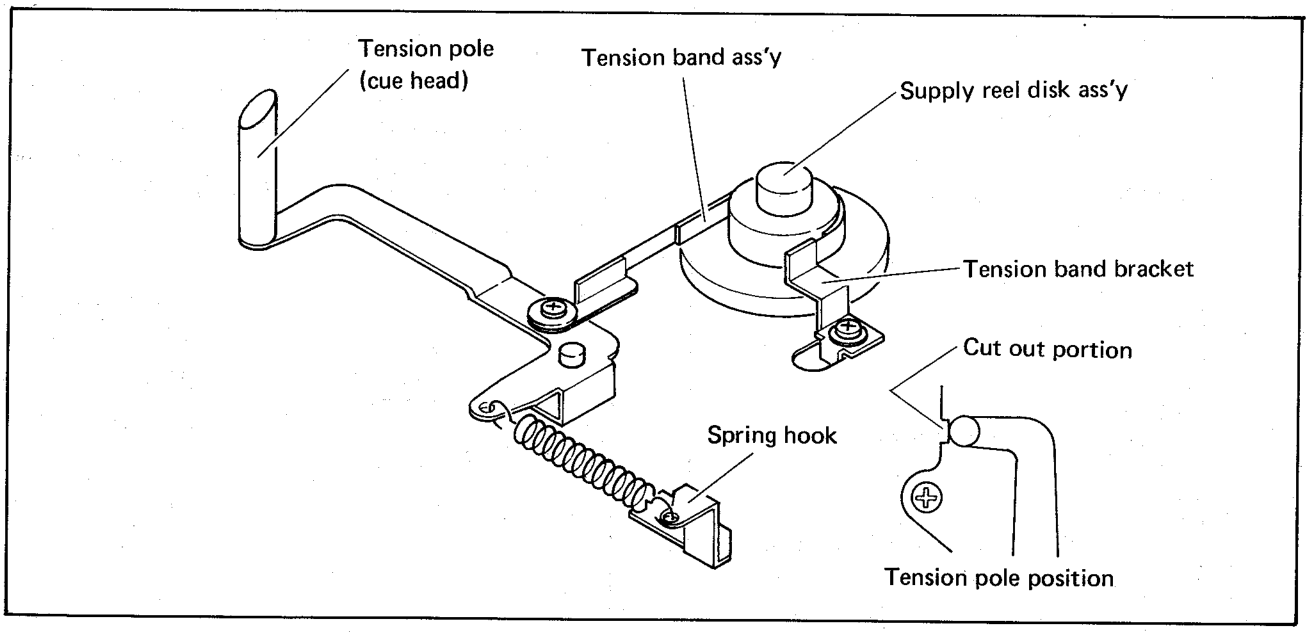

Tension pole (cue head)
Tension band ass'y
Supply reel disk ass'y
Tension band bracket
Cut out portion
Spring hook
Tension pole position

Fig. 5-30 Tension pole position

5.5 TAPE TRANSPORT OPERATION

5.5.1 Tape transport check

1. Employ self-recording tape and operate the machine between Play and Stop modes several times.
   Check according to the following steps.
2. During Play mode, observe tape at the input and output portions (A and B in Fig. 5-32) of the head drum lead.
   Confirm that the tape slips neither upward or downward with respect to the lead as shown in Fig. 5-33.

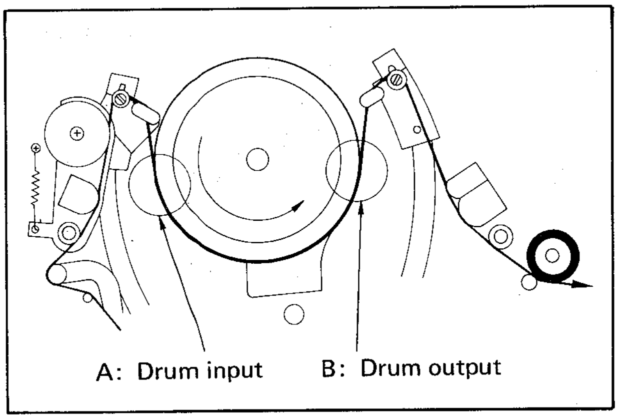


Fig. 5-32 Tape transport check

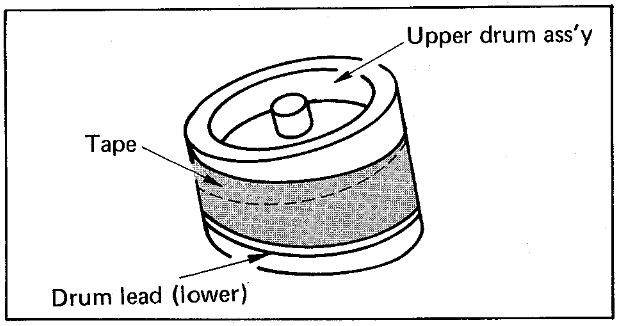


Fig. 5-33 Drum lead check-1

NOTES:

1. *Slips upward : sound becomes produced by contact between tips of rotating heads and edge of tape.*
2. *Slips downward : tape curls or wrinkles from contacting lead face (sound may also be produced).*

3. During loading, Play and unloading, observe the tape at the supply and take up guide rollers and guide poles.
   Confirm absence of curling, wrinkling, etc as shown in Fig. 5-34.

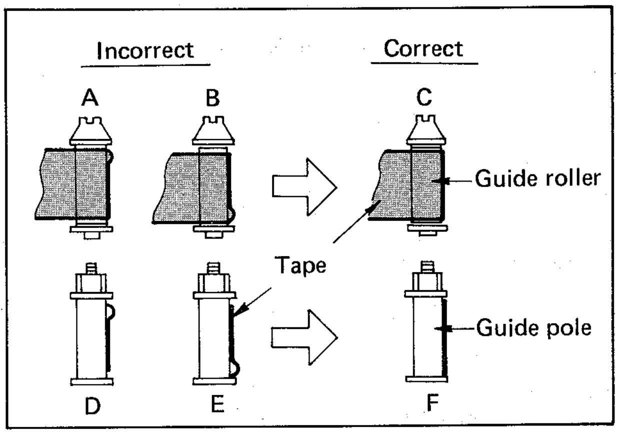


Fig. 5-34 Guide roller and Guide pole

4. Observe the tape as it becomes wrapped around drum during loading and as it separates from the drum during unloading.
   Confirm absence of damage to the tape at points C and D as shwon in Fig. 5-35 and absence of contact noise between head tips and tape edge.

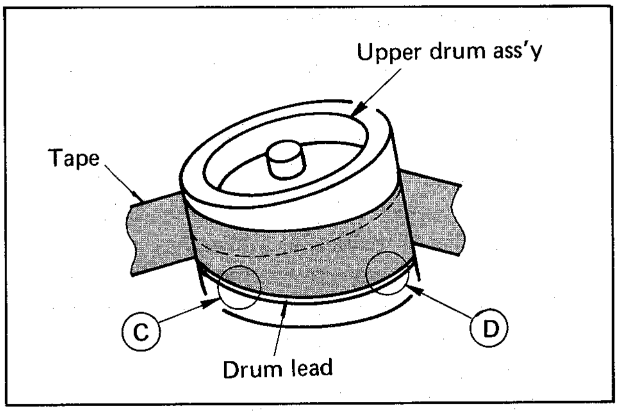


Fig. 5-35 Drum lead check-2

5.5.2 Tape transport adjustments

Perform only if defects are noted during tape transport check (5.5.1).

A: Guide roller height

1. Slightly loosen setscrews of the supply and take up guide rollers as shown in Fig. 5-36.
2. Use self-recording tape and set for Play mode.
3. With a slotted screwdriver, slightly turn the supply guide roller (do not turn more than 180° at a time) and adjust so that at the drum input, the tape travels smoothly in the drum lead without slipping upwards or downwards.
4. Similarly, adjust the take up guide roller for the drum output.

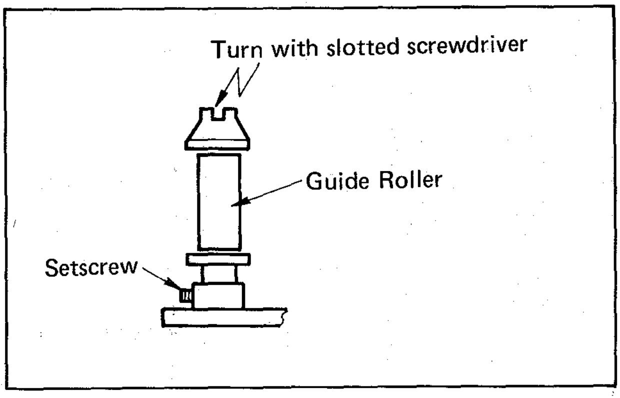

Turn with slotted screwdriver
Guide Roller
Setscrew

Fig. 5-36 Guide roller height

NOTES:

1. *Loosen the setscrews only enough to allow the guide rollers to be turned.*
   If excessively loose, tape motion may turn the rollers inadvertently.
2. *Turn the rollers carefully to avoid damage to the tape.*

B: Supply guide pole height

Perform only if defect is noted during checks of section 5.5.1.

1. Use self-recording tape and set for Play mode.
2. Use a nutdriver to turn the supply guide pole to align the upper flange of the guide pole with the upper edge of the tape as shown by F of Fig. 5-34. However, this adjsutment must be performed so that at the same time, the upper flange remains within ±0.5 mm of the height adjusting jig portion shown in Fig. 5-27.
   If there is a large discrepancy, check the height of the supply reel disk, tension pole and other mechanical components.

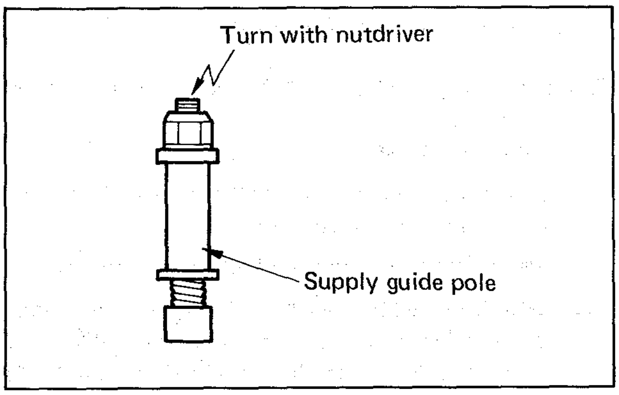

Turn with nutdriver
Supply guide pole

Fig. 5-37 Supply guide pole height

C : Take up guide pole

NOTE: Do not adjust the height of the take up guide pole itself.

1. Employ self-recording tape and set for Play mode.
2. Turn audio/control head screw Ⓒ as shown in Fig. 5-38 and adjust for smooth transport at the take up guide pole as shown by F of Fig. 5-34.

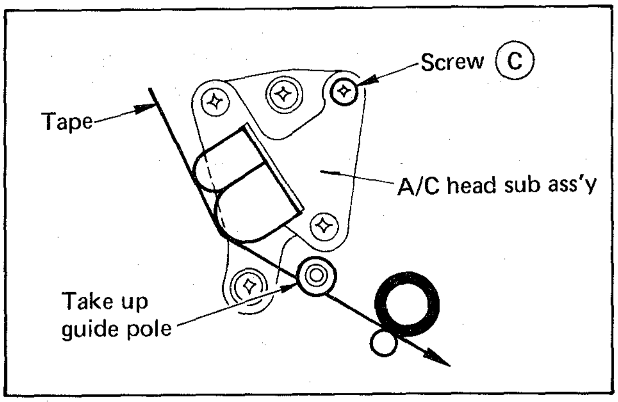

Screw Ⓒ
Tape
A/C head sub ass'y
Take up guide pole

Fig. 5-38 Take up guide pole

5.6 INTERCHANGEABILITY ADJUSTMENT

Before using alignment tape, employ self-recording tape and confirm correct tape transport.

5.6.1 Preliminary checks

A : Check sequence 1

1. Connect oscilloscope to PRE/REC TP-6 (FM MIX. out).
   At this time, trigger the oscilloscope externally with the signal (25Hz square wave) from SERVO-1 TP-17 (DRUM F.F in) and set oscilloscope sync slope to minus (–).

NOTE:
The track widths of both heads are wider than those of standard models, while the CH-2 track width is wider than CH-1.
Therefore when checking FM output, observe the CH-1 FM output only.

2. Play stairstep portion of the alignment tape.
3. Turn the Normal/Speed tracking control and adjust for maximum FM output at PRE/REC TP-6.
   Set the Normal/Speed Tracking control to AUTO (center click position) and confirm that nearly maximum output is obtained.

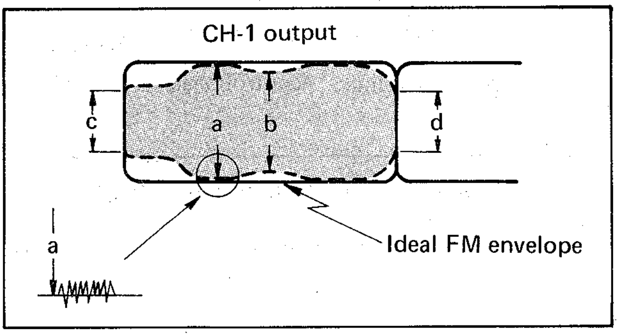


Fig. 5-39 CH-1 FM waveform (max. output)

4. Refer to Fig. 5-39. Read the level of portion (a) of the waveform. If the waveform is serrated at point (a), read the valve at the most uniform serrations as shown at left in Fig. 5-39.
5. As shown by the broken lines, read the FM waveform value at point (b) and confirm that:

$$\frac{b}{a} \geqq 0.7 \text{ or } 20 \log \frac{b}{a} \geqq -3\,\text{dB}$$

6. Read the values at points (c) and (d) [drum input and output] and confirm that:

$$\frac{c}{a} \geqq 0.5 \text{ and } \frac{d}{a} \geqq 0.5 \; (\geqq -6\,\text{dB})$$

NOTES:

1. *Read minimum levels for (b), (c) and (d).*
2. *If above checks yield normal results, proceed to section 5.6.1-B.*
3. *If defects are noted, perform adjustments of section 5.6.2.*

B : Check sequence 2

1. Observe the FM waveform as in the previous section (5.6.1-A) and turn the Normal/Speed Tracking control.
   The waveform variation should be nearly parallel as shown in Fig. 5-40.
2. If the waveform varies as shown in Fig. 5-41, adjustment becomes required.

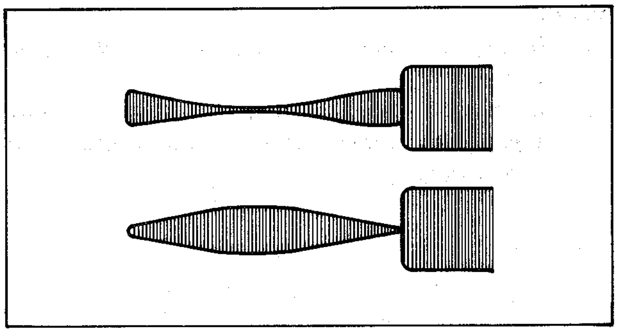


Fig. 5-41 Incorrect waveform examples

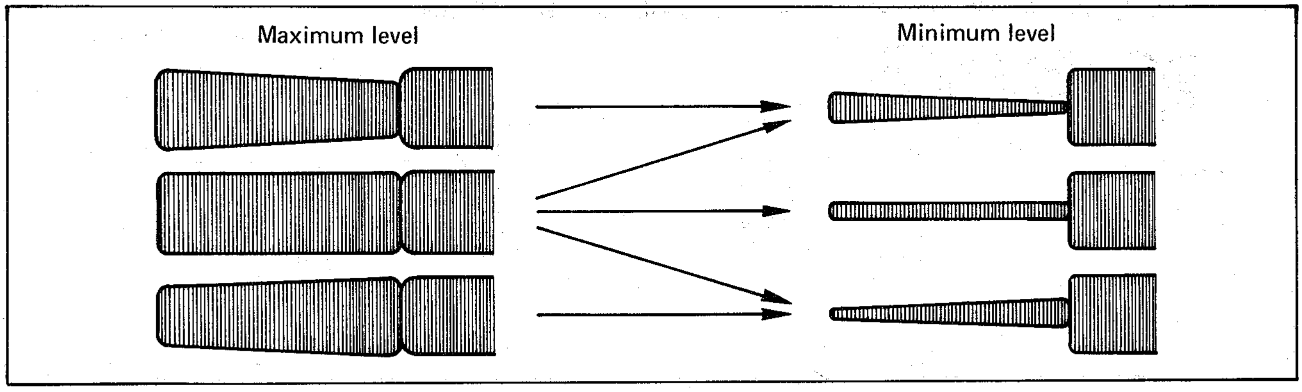


Fig. 5-40 Normal waveform examples

5.6.2 Preliminary adjustments

1. Loosen the setscrews of the supply guide roller and take up guide roller.
   If the guide rollers turn freely, slightly tighten the setscrews.
2. Without the cassette housing ass'y, open cassette cover and insert cassette.
   At this time, place a weight on the cassette to hold the cassette in place (note Cassette switch).
3. Connect oscilloscope to PRE/REC TP-6 (FM MIX. OUT).
   Trigger the oscilloscope externally with the signal from SERVO-1 TP-17 (DRUM F.F in) and set oscilloscope sync slope to minus (–).
4. Play alignment tape (stairstep signal).

A : Drum input

1. Observe oscilloscope display and adjust the Normal/Speed Tracking control for maximum FM output.
2. Refer to Fig. 5-42. Examples of incorrect waveforms are shown by A.
   Use a slotted screwdriver to adjust the supply guide roller so that the rising portion (drum input portion) of the waveform becomes flat as shown by B.

NOTES:

1. *If the guide roller turns freely, tighten the setscrew slightly.*
2. *Be sure to adjust the guide roller only by small amounts at a time in order to avoid damaging the alignment tape.*
   In addition to observing the waveform, confirm absence of tape slippage of curling at the drum lead and guide poles.
3. *At the supply guide pole, if the tape separates from the guide or wrinkling occurs, adjust the guide pole height.*
   Align the upper flange of the guide pole with the tape as shown in Fig. 5-42.

B : Drum output

1. In the same manner as for the drum input, turn the take up guide roller to adjust the falling portion (drum output portion) of the FM waveform.
   Incorrect examples are shown by Ⓒ in Fig. 5-44, while D indicates the correct adjustment.
2. If the tape separates from the guide or wrinkling occurs at the take up guide pole, adjust by turning screw Ⓒ of the audio/control head as shown in Fig. 5-44.

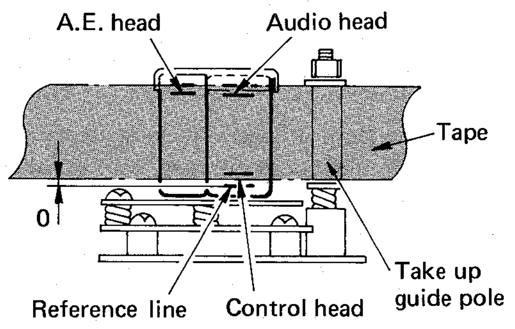


Fig. 5-43 Audio/control head height

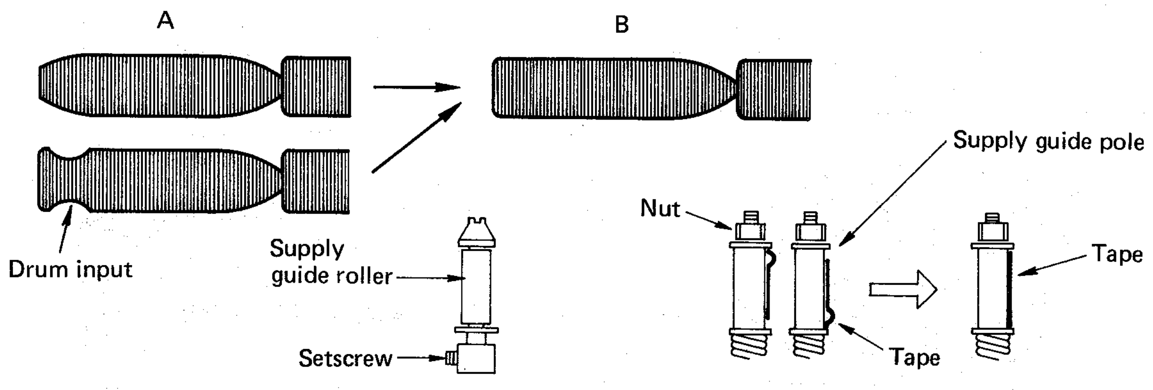


Fig. 5-42 Drum input adjustments

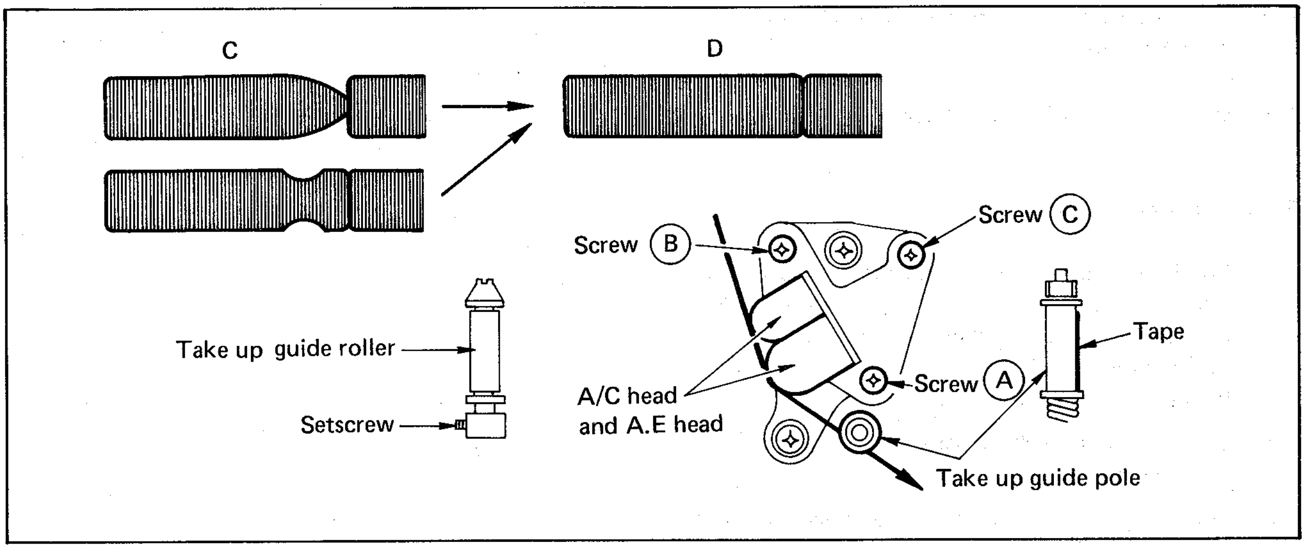


Fig. 5-44 Drum output adjustment

3. Carefully and evenly adjust screws Ⓐ, Ⓑ and Ⓒ to align the audio/control head height with the tape as shown in Fig. 5-43.

NOTES:

1. *Fine adjustment is not required at this time.*
   It is sufficient that the tape is engaged with the guide pole and servo operates stably (control signal picked up).
2. *If the tape separates from the take up guide pole or wrinkling occurs, screw Ⓒ (Fig. 5-44) has been turned excessively with respect to screws Ⓐ and Ⓑ, causing the audio/control head to incline forward or rearward. Use care to adjust screws Ⓐ, Ⓑ and Ⓒ evently and observe that small wrinkles are not produced at the take up guide pole.*
3. *Do not disturb the take up guide pole.*

5.6.3 Interchangeability fine adjustment

1. Connect oscilloscope to PRE/REC TP-6 (FM MIX. OUT).
   Observe the CH-1 FM waveform and adjust the Normal/Speed Tracking control for minimum FM output level.

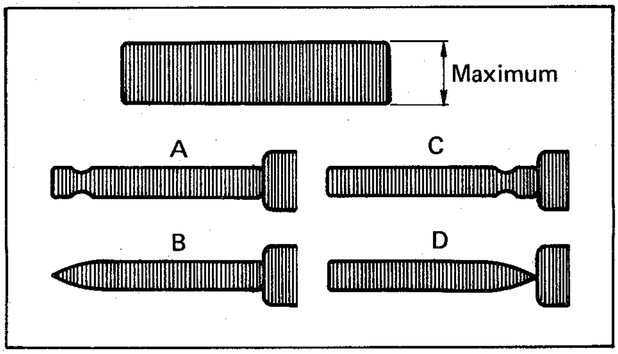


Fig. 5-45 Minimum FM output (incorrect examples)

2. If the waveform becomes as shown by A or B of Fig. 5-45, carefully adjust the supply guide roller height so that the waveform becomes as shown by E, F or G of Fig. 5-46.
   AT this time, if the waveform fluctuates, adjust to the point of minimum fluctuation.

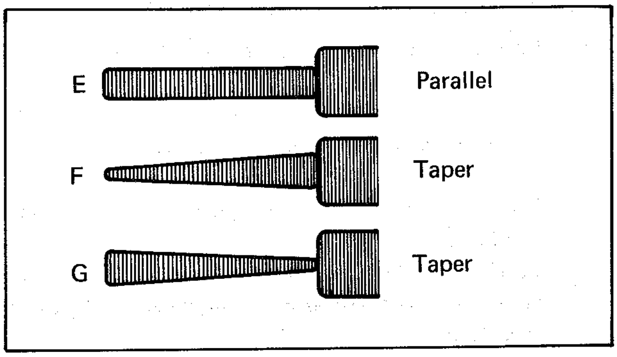


Fig. 5-46 Minimum FM output (correct examples)

3. If the FM waveform appears as shown by C and D in Fig. 5-45, carefully adjust the take up guide roller height to obtain a waveform such as shown by E, F or G of Fig. 5-46.
   At this time, if the waveform fluctuates, adjust to the point minimum fluctuation.
4. Vary the Normal/Speed Tracking control from maximum to minimum FM output.
   Perform fine adjustment of supply and take up guide rollers so that waveform variation becomes as shown by E, F and G of Fig. 5-46.

5.6.4 Audio/Conrol head height, azimuth and inclination

See section 5.3.3 Audio/control head.

5.6.5 Setscrew tightening

1. Check for maximum FM output waveform (Fig. 5-45), maximum audio out (Fig. 5-9) and absence of tape wrinkling or other transport irregularities, then secure the guide rollers.
   Perform in stop mode.
2. Since the guide rollers are easily moved, use care when securing.
3. After tightening the setscrews, again perform interchangeability final checks.

5.6.6 Interchangeability final checks

Confirm section 5.6.1 Preliminary checks.

5.6.7 Servo circuit adjustment

1. Playback switching point (see section 6.3.9)
2. Recording switching point (see section 6.3.10)
3. Normal tracking preset (see section 6.3.12)
4. Control head phase (see section 6.3.18)

5.6.8 Final checks (recording and playback)

1. Use self-recording tape and perform recording and playback.
   Confirm FM waveform and specifications equivalent to those during playback of alignment tape (stairstep signal).
   See section 5.6.1.
2. Perform checks and adjustments of the audio recording and playback levels and the audio circuit.
3. Check other signal systems by referring to section 6, electronic adjustment.

SECTION 6
ELECTRONIC ADJUSTMENTS

6.1 GENERAL

6.1.1 Introduction

Prior to adjusting, be sure to perform all necessary repairs and replacements. In the case of complex products, such as VHS and its related equipment, it may be possible to temporarily "adjust out" the effects of a faulty component. The resulting unstable condition invariably leads to costly "call backs" and re-repairs. For this reason, in event of electrical circuit malfunction, by all means use test instruments to locate and repair the point of failure before proceeding with adjustments.

6.1.2 Required test equipment

1. Digital voltmeter : Hewlett-Packard Model 3476A or equivalent
2. Oscilloscope : Wide-band, dual trace
3. TV signal generator : With color bar and stairstep signal outputs
4. Frequency counter : Hewlett-Packard Model 5381A or equivalent
5. Regulated DC power supply
6. Audio signal generator
7. Alignment tape : JVC MH-2

NOTE:

Be sure to check for smooth and proper tape transport before using the alignment tape. Do not use the alignment tape for mechanism operation checks.

MH-2 Alignment Tape Contents

Segment	Video Signal	Audio Signal	Applications	Time
1	Stairstep	7 kHz	*Interchangeability checks and adjustments *Drum servo circuit adjustments *Audio head azimuth adjustment Note: Set TRACKING control to PRESET.	10 minutes
2	–	3 kHz	*Tape speed check *Wow and Flutter check	5 minutes
3	Color bar	1 kHz	*Video signal playback adjustments *Audio signal playback adjustments Note: Set TRACKING control to MANUAL and employ with maximum FM level at TP-6 (FM MIX. OUT) of the PRE/REC board.	10 minutes
4	RF sweep	–	*Video head resonance adjustment	3 minutes

6.2 POWER SUPPLY CIRCUIT

All following test points and potentiometers are located on the power supply board.

6.2.1 10 V DC power supply

1. Connect DC voltmeter to TP-1 (10 V REG OUT) and adjust R9 (10 V REG) for 10.0 ± 0.2 V DC.
2. Check for AC ripple of less than 10 mVp-p at TP-1.

6.2.2 12 V DC power supply

1. Connect DC voltmeter to TP-2 (12 V REG OUT) and adjust R19 (12 V REG) for 12.0 ± 0.2 V DC.
2. Verify AC ripple of less than 5 mVp-p at TP-2.

6.2.3 15 V DC power supply

1. Connect DC voltmeter to TP-8 (15 V REG OUT) and adjust R23 (15 V REG) for 15.0 ± 0.2 V DC.
2. Check for AC ripple of less than 5 mVp-p at TP-8.

NOTE: *With the sub power switch off, TP-2 (12 V DC) and TP-8 (15 V DC) drop to less than 1 V DC.*

6.3 SERVO CIRCUIT

This model includes two servo circuit boards, designated in the following as SERVO-1 and SERVO-2. The capstan servo circuit is contained on SERVO-1 and the drum servo circuit on SERVO-2. Perform measurements with an oscilloscope unless otherwise indicated.

6.3.1 Drum sampling position

1. Supply a video signal and set for the Recording mode.
2. On the SERVO-2 board, measure TP-14 (DRUM PHASE ERROR) and adjust R39 (DRUM SAMPLE POSI) for 5.3 ± 0.1 V DC.
3. Check TP-6 (DRUM TRAPEZOID) of the SERVO-2 board and verify a stable sampling pulse positioned at the center of the ramp. See Fig. 6-1.

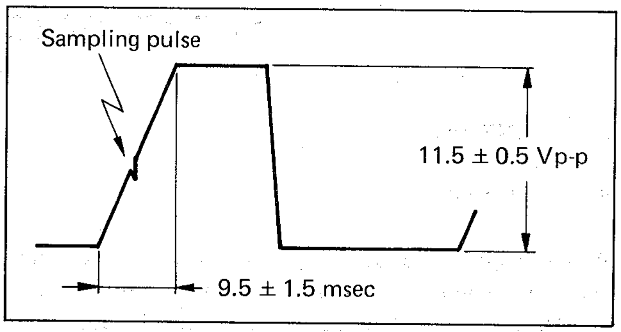


Fig. 6-1 Drum sampling position

6.3.2 Drum pulse level

1. Supply a video signal and set for the Recording mode.
2. At TP-3 (DRUM P.U. PULSE IN) of the SERVO-2 board, confirm that both positive and negative polarity levels are more than 1.6 Vp-p. See Fig. 6-2.

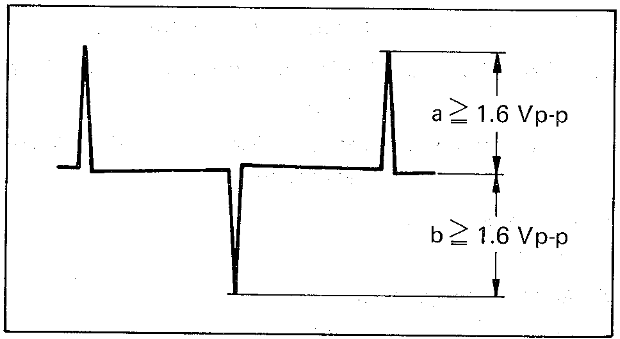


Fig. 6-2 Drum pulse level

6.3.3 Drum FG (frequency generator) level

1. Supply a video signal and set for the Recording mode.
2. As shown in Fig. 6-3, check that the level of portion (a) at SERVO-2 board TP-4 (DRUM FG AMP OUT) is more than 0.6 Vp-p.

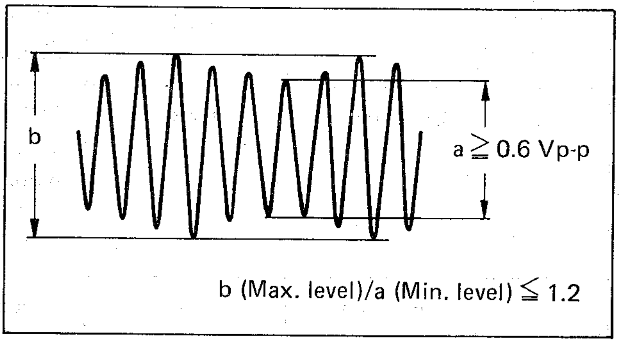


Fig. 6-3 Drum FG level

6.3.4 Drum AC ripple

1. Supply a video signal and set for the Recording mode.
2. On the SERVO-2 board, connect oscilloscope probe to TP-11 (DRUM MOTOR OUT) and ground lead to TP-12 (DRUM MOTOR GND). Confirm AC ripple of less than 50 mVp-p. See Fig. 6-4.

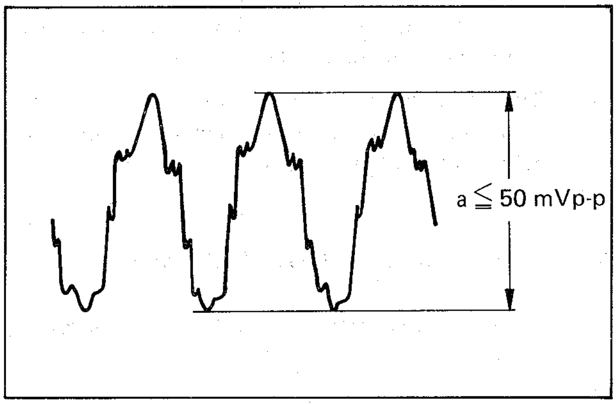


Fig. 6-4 Drum FC ripple

6.3.5 Capstan sampling position

1. Supply a video signal and set for the Recording mode.
2. On the SERVO-1 board, adjust R83 (CAP SAMPLE PULSE) for 5.3 ±0.2 VDC at TP-9 (CAP PHASE ERROR).
3. At TP-8 (CAP TRAPEZOID) of the SERVO-1 board, confirm a stable sampling pulse positioned at the center of the ramp as shown in Fig. 6-5.

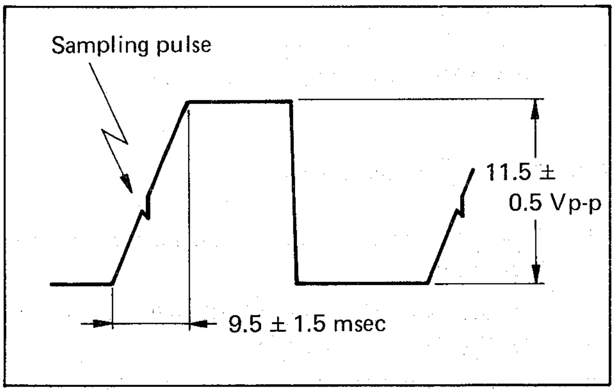


Fig. 6-5 Capstan sampling position

6.3.6 Capstan FG level

1. Supply a video signal and set for the Recording mode.
2. At TP-4 (CAP FG AMP OUT) of the SERVO-1 board, confirm that portion (a) is more than 0.5 Vp-p, as shown in Fig. 6-6.

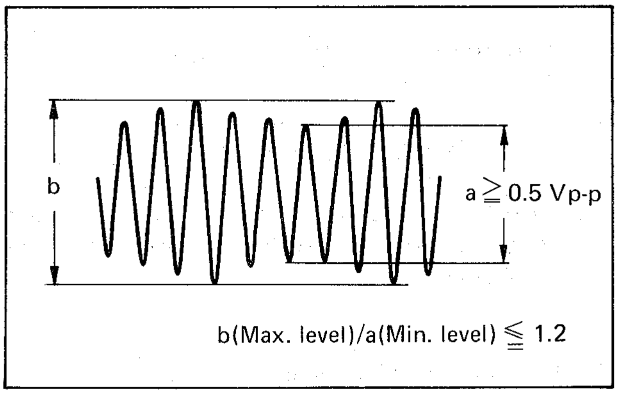


Fig. 6-6 Capstan FG level

6.3.7 Capstan AC ripple

1. Supply a video signal and set for the Recording mode.
2. Verify that AC ripple is less than 280 mVp-p at TP-14 (CAP MOTOR PLUS IN) of the SERVO-1 board. See Fig. 6-7.

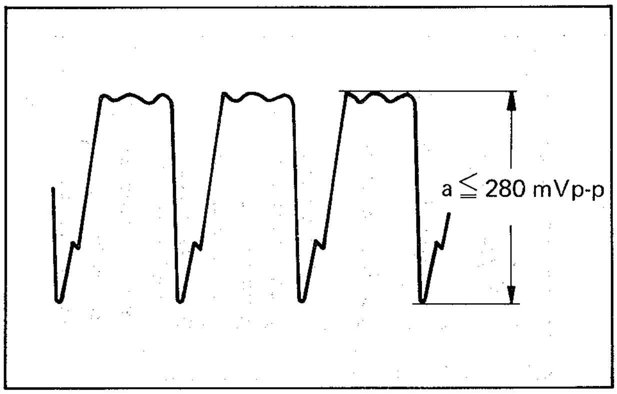


Fig. 6-7 Capstan AC ripple

6.3.8 Playback control level

1. Play alignment tape (stairstep signal).
2. At TP-1 (CTL IN) of the SERVO-1 board, check for a positive level of more than 0.5 Vp-p. See Fig.6-8.

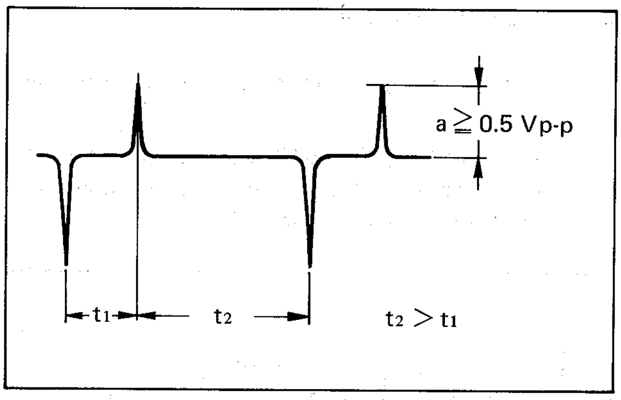


Fig. 6-8 P.B. control level

3. Supply a video signal, perform recording and playback. Confirm that the pulse level is the same as above step 2.

6.3.9 Playback switching point

1. Play alignment tape (stairstep signal).
2. Trigger the oscilloscope externally with the signal from TP-5 (DRUM FF OUT) of the SERVEO-2 board and set the oscilloscope sync slope to minus (−).
3. Connect the oscilloscope to TP-1 (SYNC IN) and adjust R30 (CH-1 SW PHASE) of the SERVO-2 board so that the rise portion of the vertical sync signal becomes positioned 6.5 H from the trigger point (switching point), as shown in Fig. 6-9.

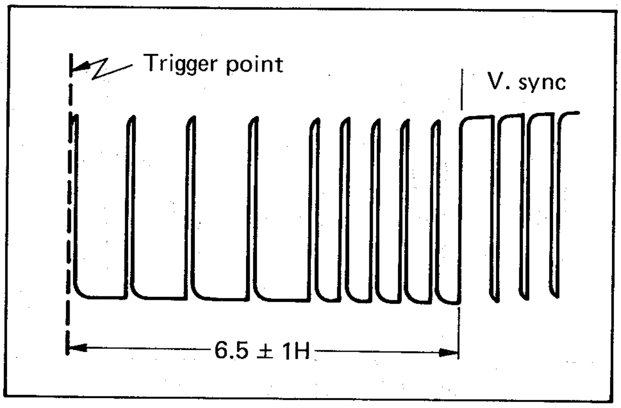


Fig. 6-9 Switching point

4. Set oscilloscope sync slope to plus (+). In the same manner as above step 3, adjust R28 (CH-2 SW PHASE) of the SERVO-2 board to obtain 6.5 H position.

6.3.10 Recording switching point

1. Supply a video signal and set for the Recording mode.
2. Trigger the oscilloscope with the signal from TP-5 (DRUM FF OUT) of the SERVO-2 board and set the sync slope to plus (+).
3. Connect oscilloscope to TP-1 (SYNC IN) and adjust R32 (REC SW PHASE) of the SERVO-2 board so that the rise portion of the vertical sync signal becomes positioned 6.5 H from the trigger point (switching point). See Fig. 6-9.
4. Set the oscilloscope slope to minus (−) and again verify that the vertical sync signal rise is positioned 6.5 ±1 H from the trigger point.

6.3.11 Recording control delay (pulse width)

1. Supply a video signal and set for the Recording mode.
2. On the SERVO-2 board, adjust R23 (REC CTL DELAY) for negative polarity pulse width of 27 msec at TP-7 (REC CTL DELAY MM OUT), as shown in Fig. 6-10.

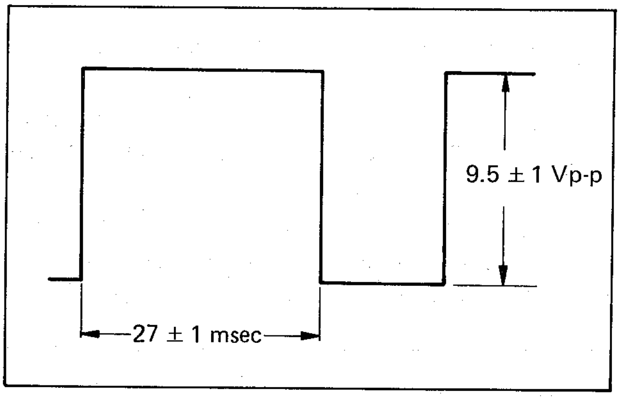


Fig. 6-10 Recording control pulse width

6.3.12 Normal tracking preset

1. Supply a video signal, record, then playback in the Speed mode.
2. Set the Normal/Speed TRACKING control to AUTO (center click position).
3. Adjust R72 (PRESET-1) of the SERVO-1 board to obtain the best picture.
4. Set for the Normal Playback mode and confirm absence of abnormal S/N.

6.3.13 Slow pulse width

1. Supply a video signal, record, then playback in the Slow-motion mode.
2. On the SERVO-1 board, adjust R149 (SLOW PULSE) so that time t2 (Fig. 6-11) at TP-14 (CAP MOTOR PLUS IN) becomes 60 msec.

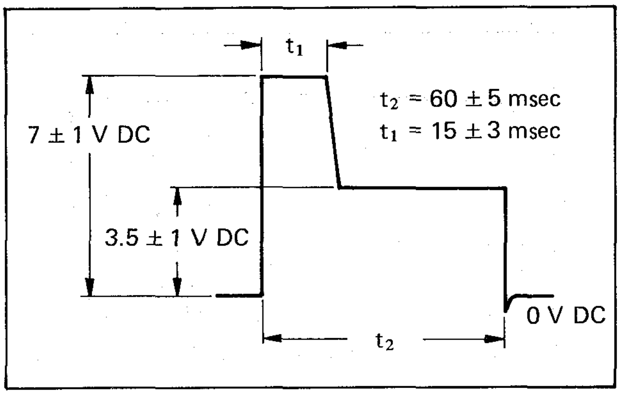


Fig. 6-11 Slow pulse width

6.3.14 Slow preset and tape start

1. Supply a video signal, record, then playback in the Slow-motion mode.
2. Adjust the SLOW control buttons for minimum speed and set the SLOW/STILL TRACKING control to AUTO (center click position).
3. Observe the picture display and when the tape is stopped, adjust R116 (SLOW PRESET) of the SERVO-1 board so that the bar noise is most nearly eliminated at the bottom of the picture.
4. Adjust the SLOW control buttons for maximum speed. While the tape is moving, adjust R129 (TAPE START) of the SERVO-1 board so that the bar noise is most nearly eliminated at the bottom of the picture.
5. Repeat the adjustments of above steps 3 and 4 to minimize bar noise in all settings of the SLOW playback mode.

6.3.15 V. pulse position

1. Supply a video signal, record, then playback in the Still mode.
2. *Trigger the oscilloscope with the signal from* TP-17 (DRUM FF IN) of the SERVO-1 board and set the sync slope to plus (+).
3. On the SERVO-1 board, adjust R132 (CH-2 V. PULSE) for maximum leftward position of the pulse at TP-12 (V. PULSE OUT). Measure the interval t (Fig. 6-12) between the V. pulse and trigger point.
4. Set the oscilloscope sync slope to minus (–). Adjust R119 (CH-1 V. PULSE) of the AUDIO board so that the interval from the trigger point becomes t + 100 μsec as shown in Fig. 6-12.

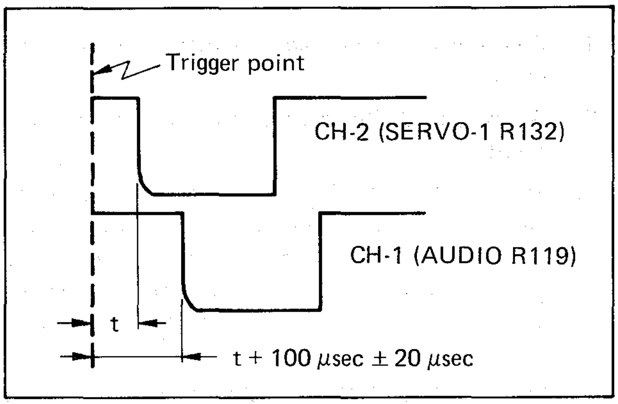


Fig. 6-12 V. pulse position

6.3.16 Drum vibration level

1. Supply a video signal, record, then playback in the Slow mode.
2. On the SERVO-2 board, adjust R70 (DRUM VIB LEVEL) for a DC level between TP-11 (DRUM MOTOR OUT) and TP-12 (DRUM MOTOR GND) of 85 mV DC. See Fig. 6-13.

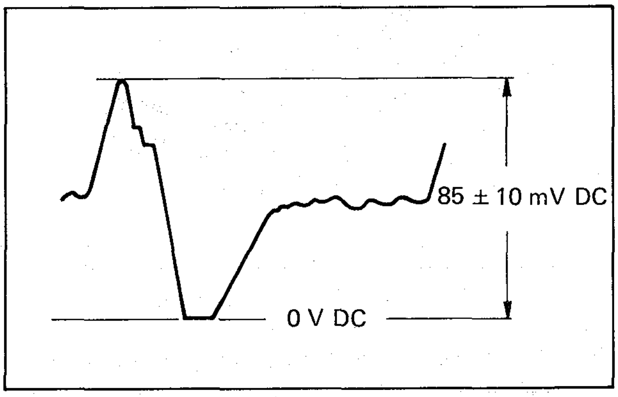


Fig. 6-13 Drum vibration level

6.3.17 Drum vibration timing

1. Supply a video signal, record, then playback in the Slow mode.
2. Observe the picture display and adjust R66 (DRUM VIB TIMING) of the SERVO-2 board to minimize jitter.

6.3.18 Control head phase

1. Play the alignment tape (stairstep) in the Slow mode.
2. Adjust the SLOW control buttons for minimum speed.
3. Set the SLOW/STILL TRACKING control to AUTO (center click position). Confirm that there is no appreciable difference in picture quality between this setting and the optimum manual adjustment of the control. If necessary, adjust as follows.
4. Set the SLOW/STILL TRACKING control to AUTO.
5. Loosen two screws D (Fig. 6-14) of the audio/control head base. Slightly move the entire audio/control head base in the direction of tape traveland set it to the position for minimum bar noise at the bottom of the picture. Tighten the two screws D.

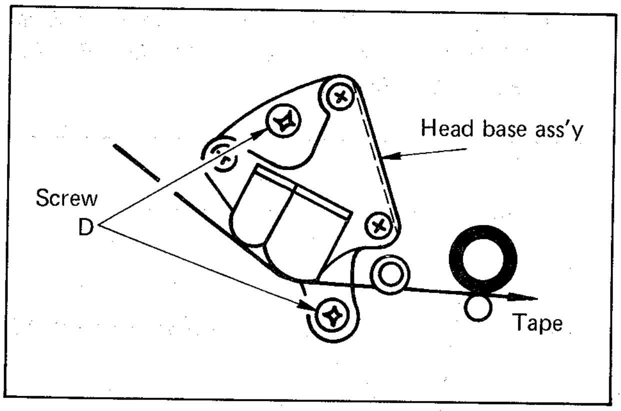


Fig. 6-14 Control head phase

NOTE: *The audio/control head position is adjusted for maximum contact between the head and tape. The head is moved in the direction of tape travel (from the supply to the take-up side).*

6.3.19 Shuttle search tape speed

1. Play alignment tape (stairstep signal) in the Shuttle Search FF or REW mode.
2. At TP-2 (CTL AMP OUT) of the SERVO-1 board, confirm a pulse interval of 4.0 ± 0.5 msec and that the deviation component is within 0.5 msec (T and t in Fig. 6-15).

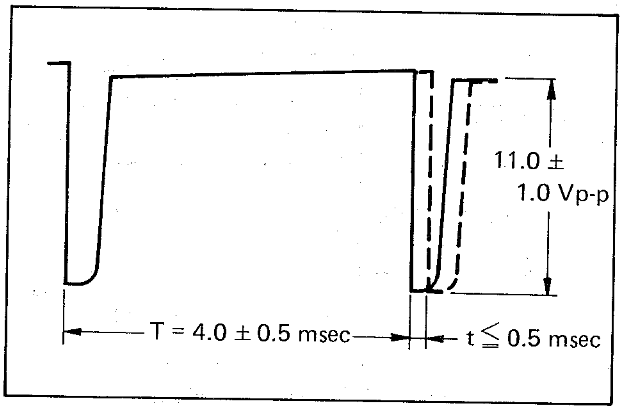


Fig. 6-15 Shuttle search tape speed

6.3.20 Shuttle search drum speed

1. Play alignment tape (color bar signal).
2. Observe the picture in the S-FF mode and adjust R48 (S-FF POSI) of the SERVO-2 board to eliminate hue deviation.
3. Similarly, set for the S-REW mode and adjust R51 (S-REW POSI) of the SERVO-2 board.

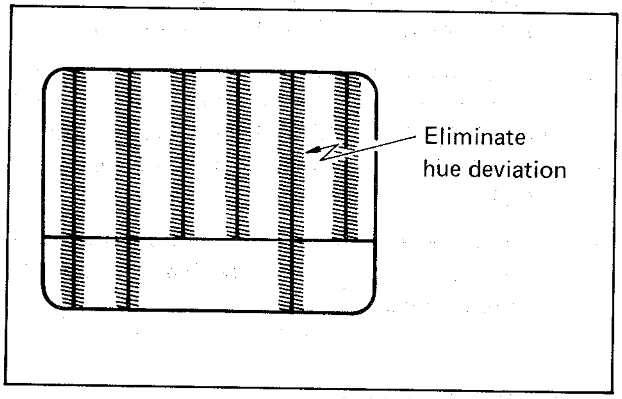


Fig. 6-16 Shuttle search drum speed

6.3.21 Edit tracking preset

1. Connect a jumper wire between TP-11 (REC START IN) and TP-13 (GND) of the SERVO-1 board. Similarly, connect a jumper wire between TP-7 (SERVO EDIT IN) and ground of the AUDIO board.
3. On the SERVO-1 board, adjust R66 (PRESET-2) for T = 25 msec (Fig. 6-17) at TP-7 (TRACKING MM OUT).

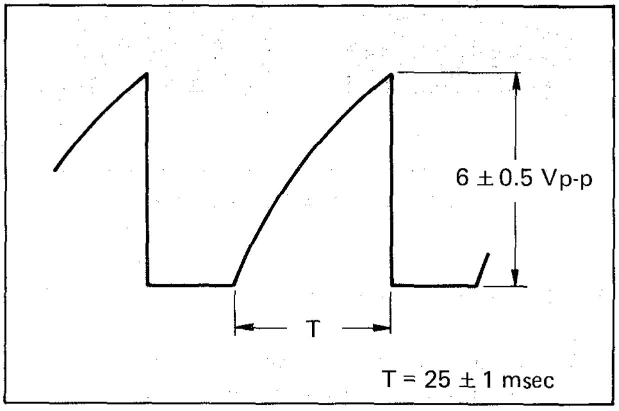


Fig. 6-17 Edit tracking preset

6.4 PLAYBACK LUMINANCE SIGNAL SYSTEM

The luminance signal system is distributed between the PRE/REC (preamplifier/recording) and the Y/COLOUR (Luminance/colour) boards. After checks and adjustments using the alignment tape, perform recording and playback with self-recording tape, then repeat the checks.

6.4.1 Video head resonance and Q (quality factor)

NOTE: *This adjustment is generally unnecessary except when replacing the upper drum assembly.*

Factory Service

1. Apply the sweep signal from a video sweep generator to TP-1 (CH-1 VIDEO HEAD IN) of the PRE/REC board. Insert 1.0 MHz and 5 MHz markers.
2. In the Stop mode, connect the oscilloscope to TP-3 (CH-1 FM OUT) of the PRE/REC board. Adjust the sweep gain so that the waveform does not distort as observed with the oscilloscope.
3. Adjust C9 (CH-1 Fo) of the PRE/REC board for maximum level at the 5.0 MHz marker portion. See Fig. 6-18.

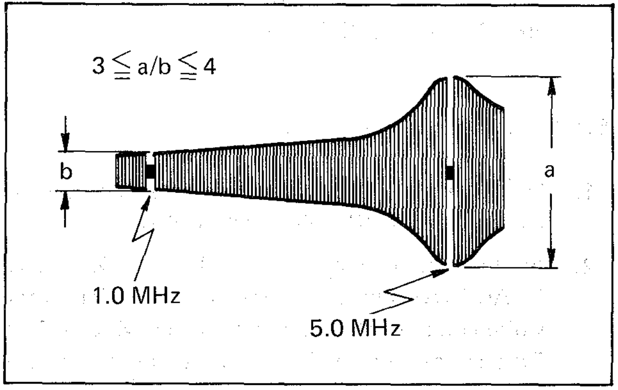


Fig. 6-18 Video head resonance and Q

4. Adjust R8 (CH-1 HEAD Q) of the PRE/REC board so that the 1 MHz level becomes 1/4 of the 5.0 MHz level.
5. In the same manner, adjust for CH-2. On the PRE/REC board, apply sweep to TP-2 (CH-2 VIDEO HEAD IN), monitor TP-4 (CH-2 FM OUT), and adjust C10 (CH-2 Fo) and R9 (CH-2 HEAD Q).

NOTE: *If Q cannot be adjusted to 4 times, adjust for equal Q at both channels (adjust the higher to match the lower). However, Q must be greater than 3 times.*

Non-factory Service

1. Play alignment tape (RF sweep signal).
2. On the PRE/REC board, connect oscilloscope to TP-3 (CH-1 FM OUT) and adjust C9 (CH-1 Fo) for peak level at the 5.0 MHz marker.

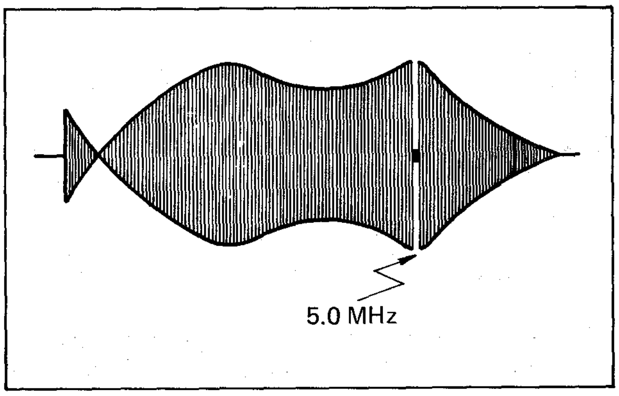


Fig. 6-19 Video head pesonance (with alignment tape)

3. In the same manner, adjust for CH-2. On the PRE/REC board, monitor TP-4 (CH-2 FM OUT) and adjust C10 (CH-2 Fo).
4. Supply a monoscope or equivalent signal, record, then playback.
5. If there is flicker or black fringing around bright objects, adjust R8 (CH-1 HEAD Q) or R9 CH-2 HEAD Q) of the PRE/REC board.

6.4.2 Limiter balance

1. Play alignment tape (color bar signal) and set the rear panel COLOR-B/W switch to B/W.
2. In the normal Play mode, adjust the X2/PLAY TRACKING control for maximum inversion of the white component. Afterwards, adjust R90 (LIMIT BAL-1) of the Y/C board to minimize this inversion.

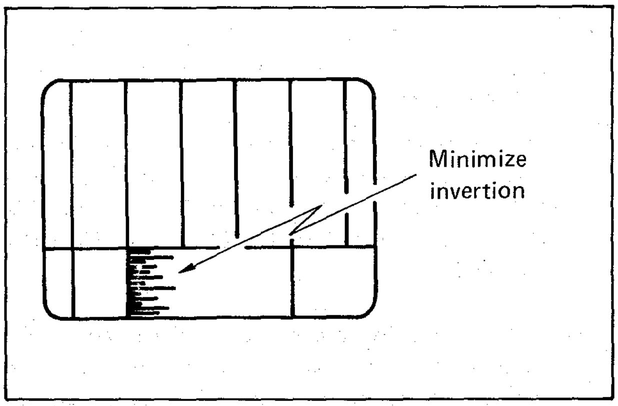


Fig. 6-20 Limiter balan

3. On the Y/C board, adjust R75 (LIMIT BAL-2) to minimize carrier leakage at TP-5 (DEMOD OUT). See Fig. 6-21.

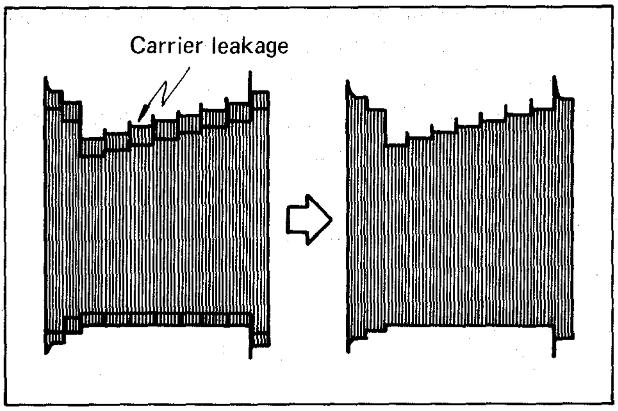


Fig. 6-21 Limiter balance-2

6.4.3 Video equalizer

NOTE: *This adjustment is generally unnecessary except when replacing the upper drum assembly.*

1. This adjusts the sharpness and softness of the playback picture. Record and off-the-air signal, then playback. While observing the picture, adjust R54 of the Y/C board for optimum clarity.

6.4.4 Playback video level

1. Play alignment tape (color bar signal).
2. On the Y/C board, adjust R61 (PB VIDEO LEVEL) for 1.9 Vp-p at TP-6 (VIDEO OUT).

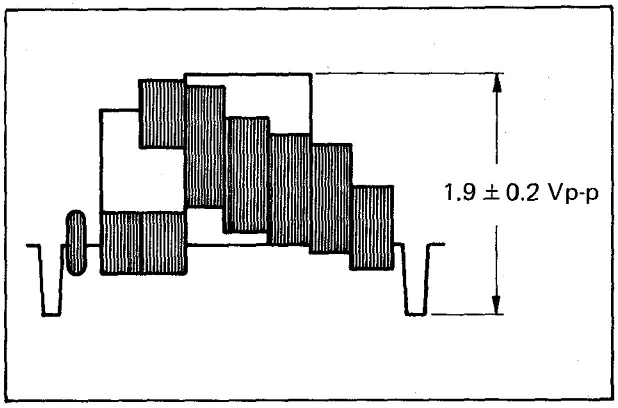


Fig. 6-22 P.B. video level

6.5 RECORDING LIMINANCE SIGNAL SYSTEM

6.5.1 Carrier balance and deviation

NOTE: *These adjustments are generally unnecessary except when replacing IC1 of the Y/C board.*

1. Supply a video signal and set for the Stop (E-E) mode.
2. Connect oscilloscope to TP-3 (PRE EMPHA OUT) of the Y/C board and precisely measure the DC potential of the sync tip. Make a note of this as voltage "A".
3. Disconnect from AC power and connect a 100 µF/16 V electrolytic capacitor between TP-3 and ground. Set a DC power supply to precisely voltage "A" and apply this voltage between TP-3 and ground. Connect a frequency counter to TP-1 (REC FM OUT) of the Y/C board. See Fig. 6-23.

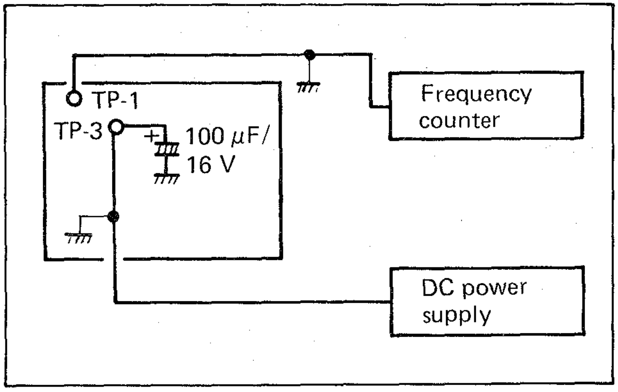


Fig. 6-23 Adjustment setup

4. Supply a video signal and again set for the Stop (E-E) mode.
5. Connect oscilloscope to TP-1 (REC FM OUT) of the Y/C board and adjust R10 (CARRIER BAL) of the Y/C board so that the modulation waveform becomes symmetrical vertically. See Fig. 6-24.
6. Adjust R11 (CARRIER) of the Y/C board for 3.8 MHz (±100 kHz) at TP-1.
7. Carefully adjust the DC power supply to obtain 4.8 MHz (±100 kHz) at TP-1. Connect oscilloscope to TP-3 (PRE EMPHA OUT) and precisely read the voltage of the DC power supply at this time. Make a note of it as voltage "B".
8. Disconnect the capacitor, DC power supply and frequency counter. Reconnect AC power.
9. Set for the Stop (E-E) mode. On the Y/C board, adjust R17 (DEVIATION) so that the white peak at TP-3 (PRE EMPHA OUT) becomes equal to voltage "B".

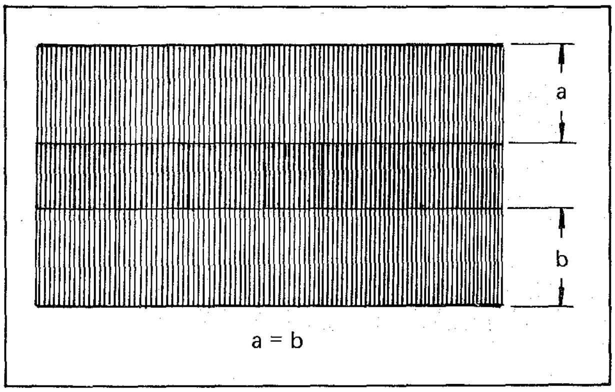


Fig. 6-24 Carrier balance

NOTE: *Check the TP-3 waveform without 100% white and dark clip.*

6.5.2 White and dark clip

1. Supply a color bar signal and set for the Stop (E-E) mode.
2. With the rated signal level taken as 100%, adjust Y/C board R19 (WHITE CLIP) so that the white peak overshoot at TP-2 (MOD IN) becomes 60%. See Fig. 6-25.
3. In the same condition, adjust R18 (DARK CLIP) of the Y/C board so that the sync tip undershoot becomes 50% at TP-2. See Fig. 6-25.

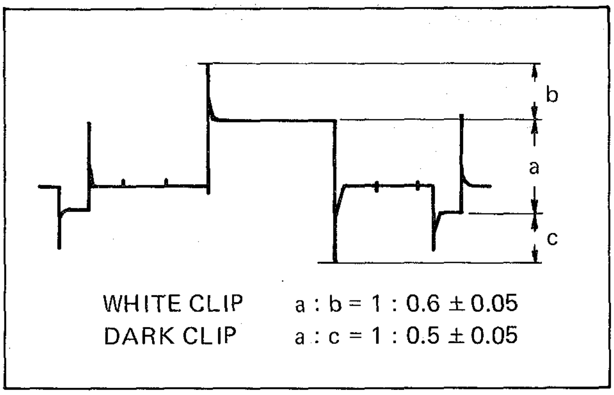

b
a
c
WHITE CLIP a : b = 1 : 0.6 ± 0.05
DARK CLIP a : c = 1 : 0.5 ± 0.05

Fig. 6-25 White and dark clip

6.5.3 FM recording level

1. Supply a color bar signal and set for the Recording mode.
2. On the PRE/REC board, adjust R30 (FM REC LEVEL) so that the pedestal level of the vertical blanking component becomes 3.0 Vp-p at TP-5 (REC AMP OUT). See Fig. 6-26.

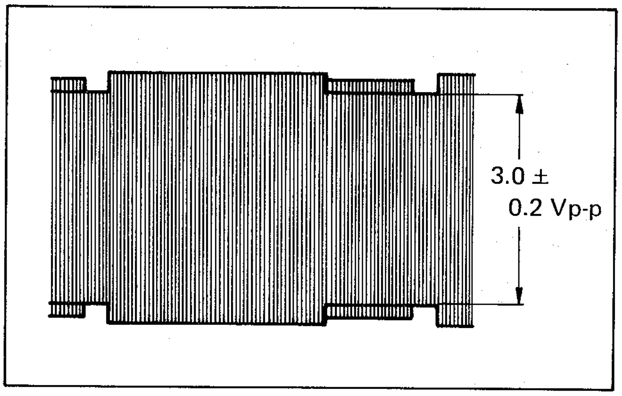


Fig. 6-26 FM recording level

6.5.4 E-E video level

1. Supply a color bar signal and set for the Stop (E-E) mode.
2. Adjust R36 (E-E LEVEL) of the Y/C board for 1.9 Vp-p at TP-6 (VIDEO OUT).

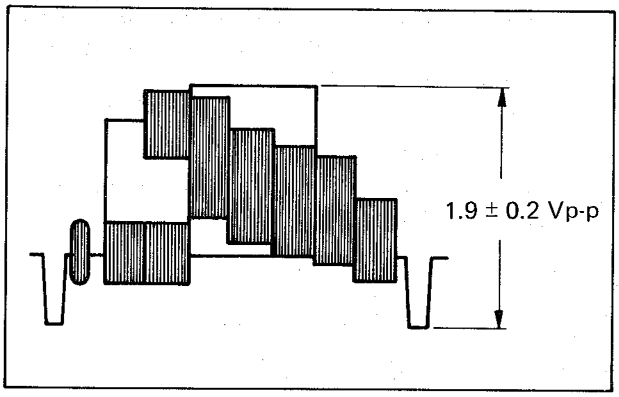


Fig. 6-27 E-E video level

6.6 COLOR SIGNAL SYSTEM

NOTE: *It is important to first perform the steps of sections 6.6.1, 6.6.2, 6.6.3 and 6.6.4 before proceeding to subsequent sections.*

6.6.1 4.433 MHz crystal oscillator

1. Play alignment tape (color bar signal).
2. On the Y/C board, connect a frequency counter to TP-207 (SUB CARR/VXO-1 OUT) and adjust C41 (SUB CARR OSC) for 4.433619 MHz ±50 Hz.

6.6.2 4.435 MHz VXO

1. Supply a color bar signal and set for the Stop (E-E) mode.
2. On the Y/C board, connect the frequency counter to TP-207 (SUB CARR/VXO-1 OUT) and adjust R266 (VXO-1) for 4.435571 MHz ±50 Hz.

6.6.3 4.433 MHz VXO

1. Without an input signal, set for the Stop (E-E) mode.
2. On the Y/C board, connect the frequency counter to TP-209 (VXO-2 OUT) and adjust R298 (VXO-2) for 4.433619 MHz ±50 Hz.

6.6.4 AFC

1. Connect a 100 μF/ 16 V electrolytic capacitor between TP-204 (Fh COMPARISON IN) of the Y/C board and ground.
2. Supply a color bar signal and set for the Stop (E-E) mode.
3. On the Y/C board, connect the frequency counter to TP-206 (Fh OUT) and adjust R240 (AFC) for 15.625 kHz ±50 Hz.

6.6.5 Color playback input level

1. Play alignment tape (color bar signal).
2. Connect oscilloscope to TP-202 (PB COL IN) of the Y/C board and adjust R56 (COL PB LEVEL) of the PRE/REC board to set the larger of the CH-1 and CH-2 outputs to 0.07 Vp-p. See Fig. 6-28.

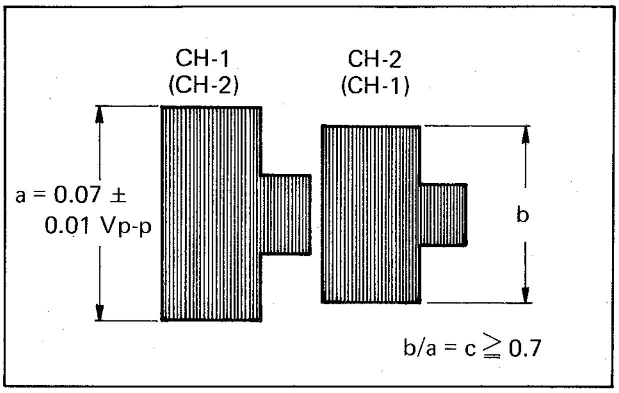


Fig. 6-28 Color P.B. input level-1

3. At this time, make a note of CH-1 output (a), CH-2 output (b) and ratio(c). Confirm that C(b/a) ≧ 0.7.
4. Supply a color bar signal, record, then playback.
5. During recording, adjust R32 (COL REC LEVEL) and R29 (COL REC BALANCE) of the PRE/REC board so that during playback, at TP-202 (PB COL IN) of the Y/C board, the higher channel output (above step 2) becomes 0.1 Vp-p and the ratio of above step 3 is obtained. In other words, adjust during recording and check during playback.

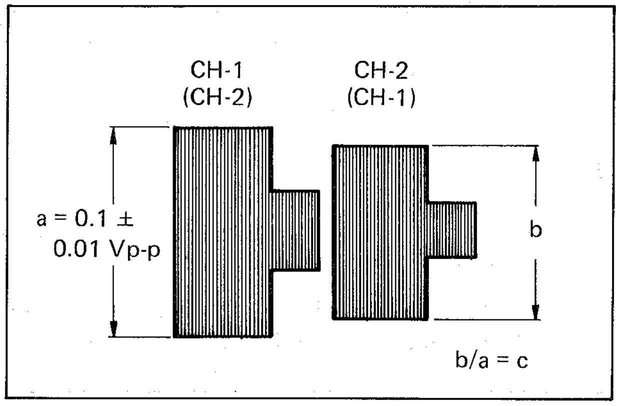


Fig. 6-29 Color P.B. input level-2

6.6.6 Main converter balance

1. Supply a color bar signal, record, then playback.
2. On the Y/C board, adjust R210 (CONV BAL) for minimum carrier leak at X202 emitter. See Fig. 6-30.

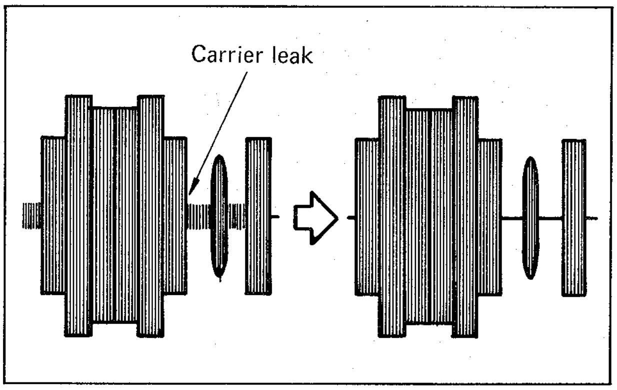


Fig. 6-30 Main converter balance

6.6.7 Comb filter

1. Supply a color bar signal, record, then playback.
2. On the Y/C board, adjust R224 (CROSSTALK CANCEL) for minimum level at TP-203 (COMB OUT).
3. Adjust L203 (7.96 MHz TRAP) for minimum level at TP-203.
4. Repeat the adjustments of R224 and L203 in order to minimize the output level (a in Fig. 6-31) at TP-203.

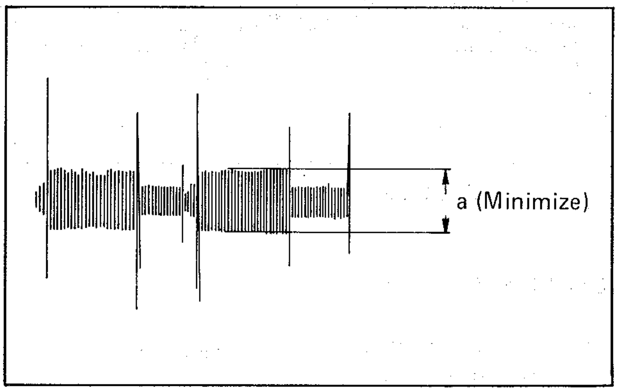


Fig. 6-31 Comb. filter

6.6.8 Playback ACC level

1. Supply a color bar signal, record, then playback.
2. On the Y/C board, adjust R278 (ACC OUTPUT LEVEL) for 0.2 Vp-p at TP-201 (ACC OUT).

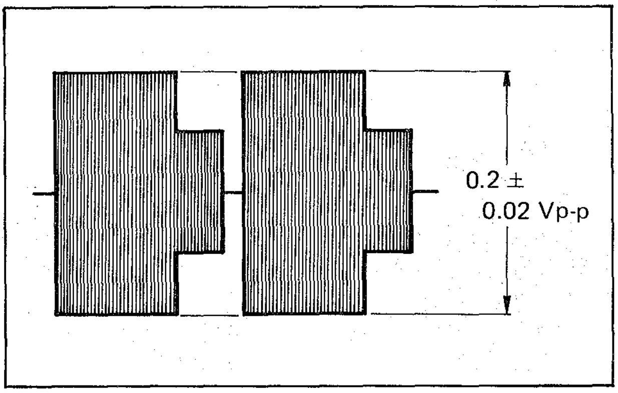


Fig. 6-32 P.B. ACC level

6.6.9 Playback color (burst) level

1. Supply a color bar signal, record, then playback.
2. On the Y/C board, adjust R86 (PB COL LEVEL) for a 0.56 Vp-p burst level at TP-6 (VIDEO OUT). See Fig. 6-33.

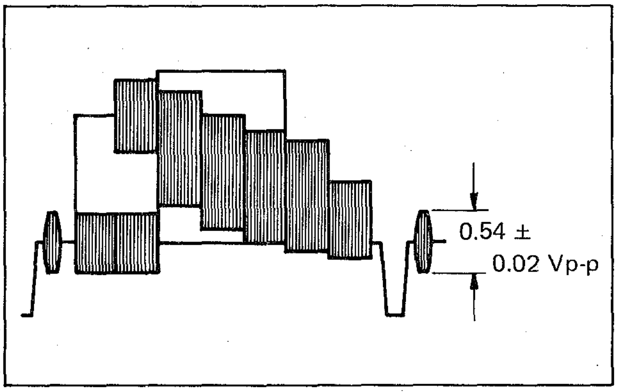


Fig. 6-33 P.B. color burst level

6.6.10 SECAM detector

1. Supply a SECAM color bar signal and set for the Stop (E-E) mode.
2. On the Y/C board, adjust L210 (4.4 MHz TRAP) for maximum DC level at TP-211 (S. DET OUT).
3. Adjust R284 (S. DETECTOR) for 10 ± 0.5 VDC at TP-208 (KILLER DET OUT).
4. Confirm high potential at IC201 pin 14.

6.7 AUDIO CIRCUIT

Unless otherwise indicated, all test points and adjustments are located on the AUDIO board.

6.7.1 Bias level

1. Without an input signal, set for the Recording mode.
2. Observe part number suffix of audio/control head (T or M).
3. If T, adjust R70 (HEAD BIAS) for 60 Vp-p at TP-5 (HEAD BIAS).
   If M, adjust for 50 Vp-p.

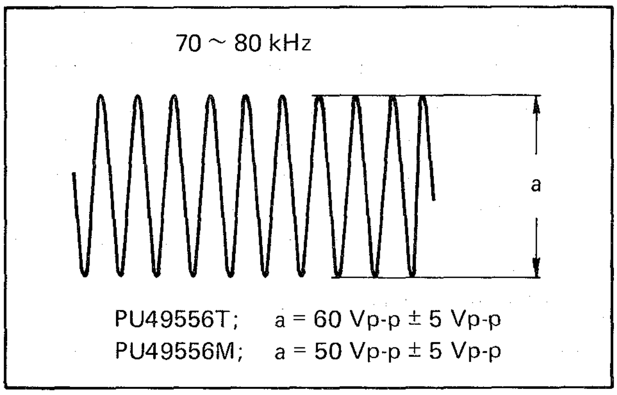

70 ~ 80 kHz
a
PU49556T; a = 60 Vp-p ± 5 Vp-p
PU49556M; a = 50 Vp-p ± 5 Vp-p

Fig. 6-34 Bias level

6.7.2 E-E level

1. Supply a 1 kHz sinewave signal at 0.22 Vp-p (−20 dB) and set for the Stop (E-E) mode.
2. Adjust R3 (E-E LEVEL) for 2.2 Vp-p (0 dB) ±0.02 Vp-p at TP-2 (AUDIO OUT).

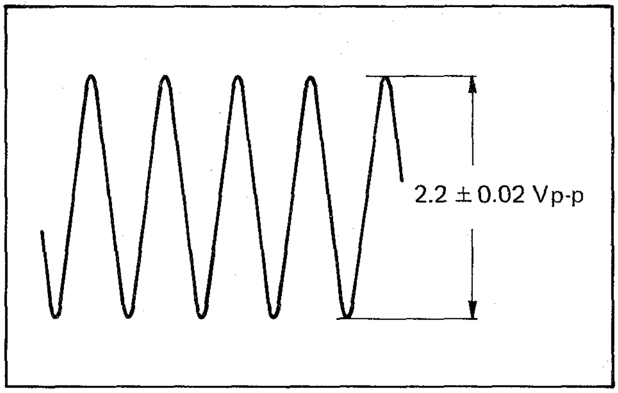


Fig. 6-35 Audio output level

6.3.3 Playback level

1. Play alignment tape (audio 1 kHz).
2. Adjust R31 (PB LEVEL) for 2.2 Vp-p (0 dB) at TP-2 (AUDIO OUT), as shown in Fig. 6-35.

6.7.4 Recording level

1. Supply a 1 kHz sinewave signal at 0.22 Vp-p (−20 dB), record, then playback.
2. During recording, adjust R45 (REC LEVEL) to obtain 2.2 Vp-p (0 dB) at TP-2 (AUDIO OUT) during playback, i.e., adjust during recording and check during playback. See Fig. 6-35.

6.7.5 Recording equalizer

1. In succession, supply 1 kHz and 7 kHz sinewave signals at 0.07 Vp-p (−30 dB), record, then playback.
2. During recording, adjust R49 (REC EQ) so that during playback, with the 1 kHz output taken as voltage "a", and the 7 kHz output as voltage "b", the following relationship is obtained:

$$0.7 \leqq \frac{b}{a} \leqq 1.2 \text{ (peak to peak)}$$

6.7.6 Voice control oscillator

1. Set for the Stop (E-E) mode.
2. Adjust R115 (CLOCK FREQ) to obtain a pulse period of 21 μsec at TP-10 (CLOCK FREQ OUT). See Fig. 6-36.

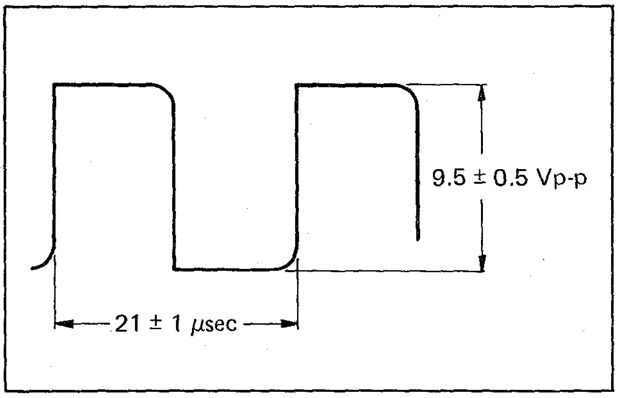


Fig. 6-36 Voice control OSC

6.7.7 Balance level

1. Supply a 1 kHz sinewave signal at 0.22 Vp-p (−20 dB) and set for the Stop (E-E) mode.
2. Adjust R94 (BIAS) to eliminate waveform distortion at TP-9 (BBD OUT).
3. Without an input signal, see the Stop (E-E) mode.
4. Adjust R97 (CLOCK BAL-A) and R98 (CLOCK BAL-B) to minimize clock noise at TP-9 (BBD OUT). See Fig. 6-37.
5. Adjust R100 (CH BALANCE) for minimum switching level difference, as shown in Fig. 6-37.

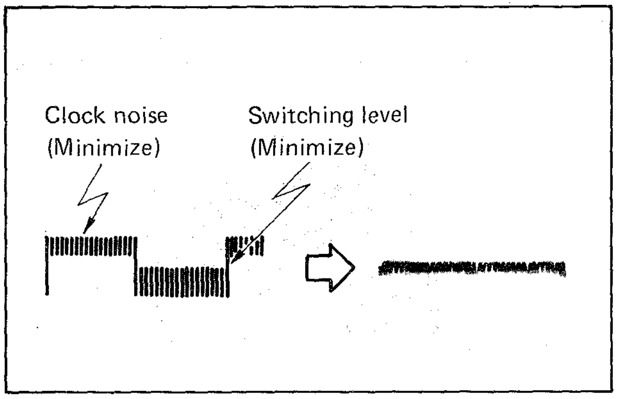


Fig. 6-37 Clock noise and switching level

6.7.8 BBD bias level

1. Play slignment tape (audio 1 kHz) in the Speed mode.
2. Adjust R94 (BIAS) to minimize waveform distortion at TP-9 (BBD OUT).

6.8 TUNER IF CIRCUIT

NOTE: *The picture IF and sound IF trap adjustments are completely the same as those of color TV receivers and earlier VHS models. Therefore, they are omitted in this manual.*

6.8.1 Video and color level

1. Use a TV channel signal generator to supply color bar and 1 kHz audio RF signals.
2. On the IF board, adjust R33 (VIDEO LEVEL) to obtain a video level of 1.0 Vp-p at TP-13 (VIDEO OUT).

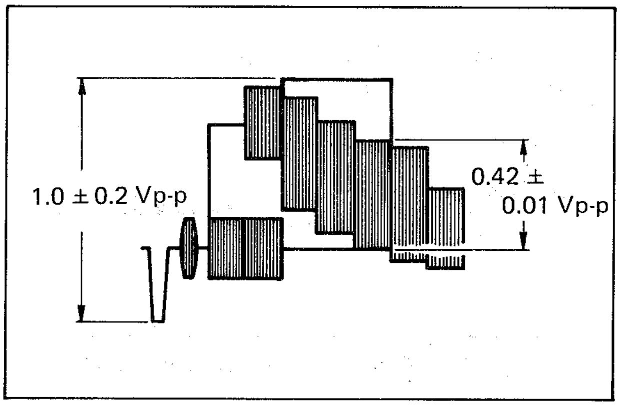


Fig. 6-38 Video output

3. Adjust R29 (COLOR LEVEL) for a 0.42 Vp-p magenta component.

6.8.2 Audio level

1. Under the conditions as section 8.1, adjust R52 (AUDIO LEVEL) for 0.3 Vp-p (−17 dBs) at TP-23 AUDIO OUT.

NOTE: *If a TV channel signal generator is not available, play the alignment tape on another (properly functioning) VHS machine and use the RF output signal. However, this method is less disirable, as it lacks the precision of a signal generator.*

6.9 TUNER AND TIMER CONTROL CIRCUIT

6.9.1 4.19 MHz cristal oscillator

1. Set for the Stop mode and conect a frequency counter to TP-2 (4.19 MHz OUT) of the T/T board. Adjust C9 (4.19 MHz OSC) of the T/T board to obtain 4.194304 MHz ±30 Hz.

6.9.2 Horizontal lock

1. Without an input signal, set for the Stop mode.
2. Connect the frequency counter to TP-3 (Fh OUT) of the T/T board and adjust R122 (H LOCK) to obtain 15.625 kHz ±10 Hz.

NOTE: *The mechanism control (mechacon) and tuner/timer control circuits are entirely controlled by microcomputers. Proper functing of these circuits is therefore checked by carefully observing the actual operation of the set. Locations for adjustments are not provided.*

SECTION 7
EXPLODED VIEWS AND PARTS LIST

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7.3 ACCESSORY LIST (M2) 7-3
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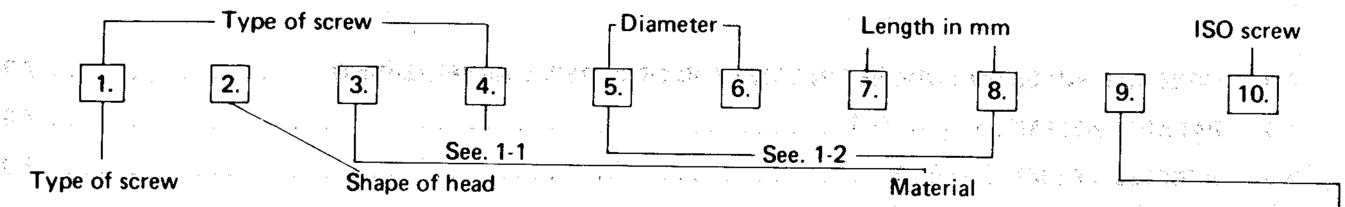
7.1 GENERAL RULES FOR NUMBERING METHOD OF SCREW/WASHER/E-RING


Type of screw
Diameter
Length in mm
ISO screw
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3.
4.
5.
6.
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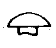
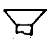
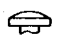
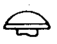
8.
9.
10.
See. 1-1
See. 1-2
Type of screw
Shape of head
Material

S	Normal screw
N	Assembly screw
L	"
D	"
M	W. Wood screw
F	Feather screw
T	Set screw
Y	"
B	Bolt
N	Nut
W	Washer
R	E-ring
E	–
P	Spring

P		Pan head
S		Flat countersunk head
H		Oval countersunk head
D		Binding head
R		Round head
B		Round head
T		Truss head

Symbol letter	Material
S	Steel
E	Stainless steel
C	Cast iron
U	Bronze
B	Brass
P	Phosphor bronze
N	German silver
Y	Brass
A	Aluminum
Z	Zinc-alloy

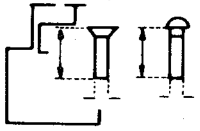
7.1.1 Type of screw

P	Cross-Recessed head screw
A	Tapping screw
B	Tapping screw

7.1.2 Diameter and Length of screw

– Example –

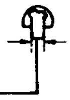
SPBP3010ZS



(Diameter x 10)

E-ring

Washer



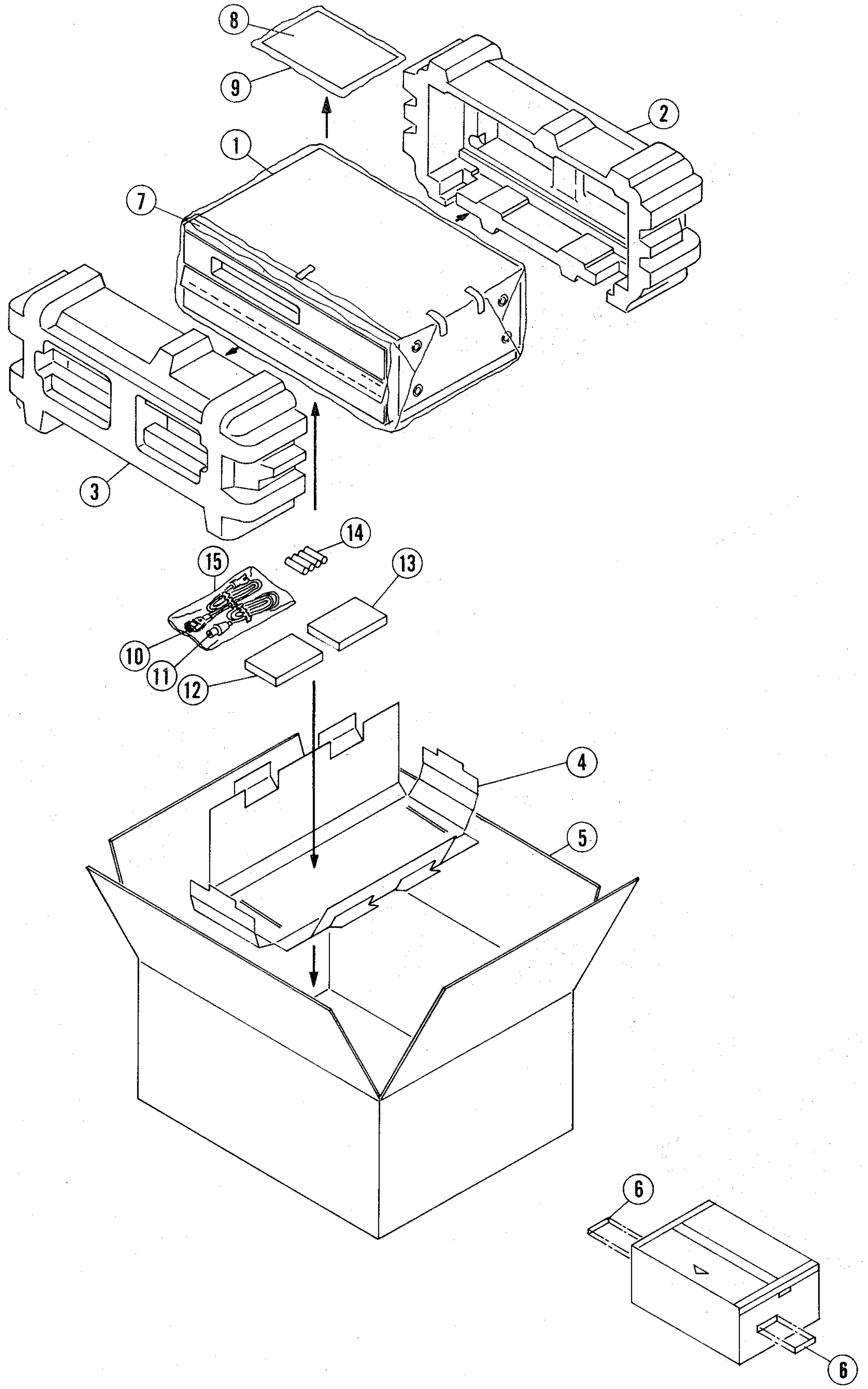
REE3000

WNS3000N

Surface treatment

Symbol letter	Surface treatment
Z	Galvanization, dichromic acid treatment (MFZn2-C)
N	Nickel plating (MFNi2, MFNil)
R	Chrome plating (MBCr2, MBCr1)
G	Silver plating (SP4)
W	Nichrome platings
P	Phosphite treatment
B	Bronze plating
M	Black coloring after galvanization
F	Iron with black coloring

7.2 PACKING ASSEMBLY M1



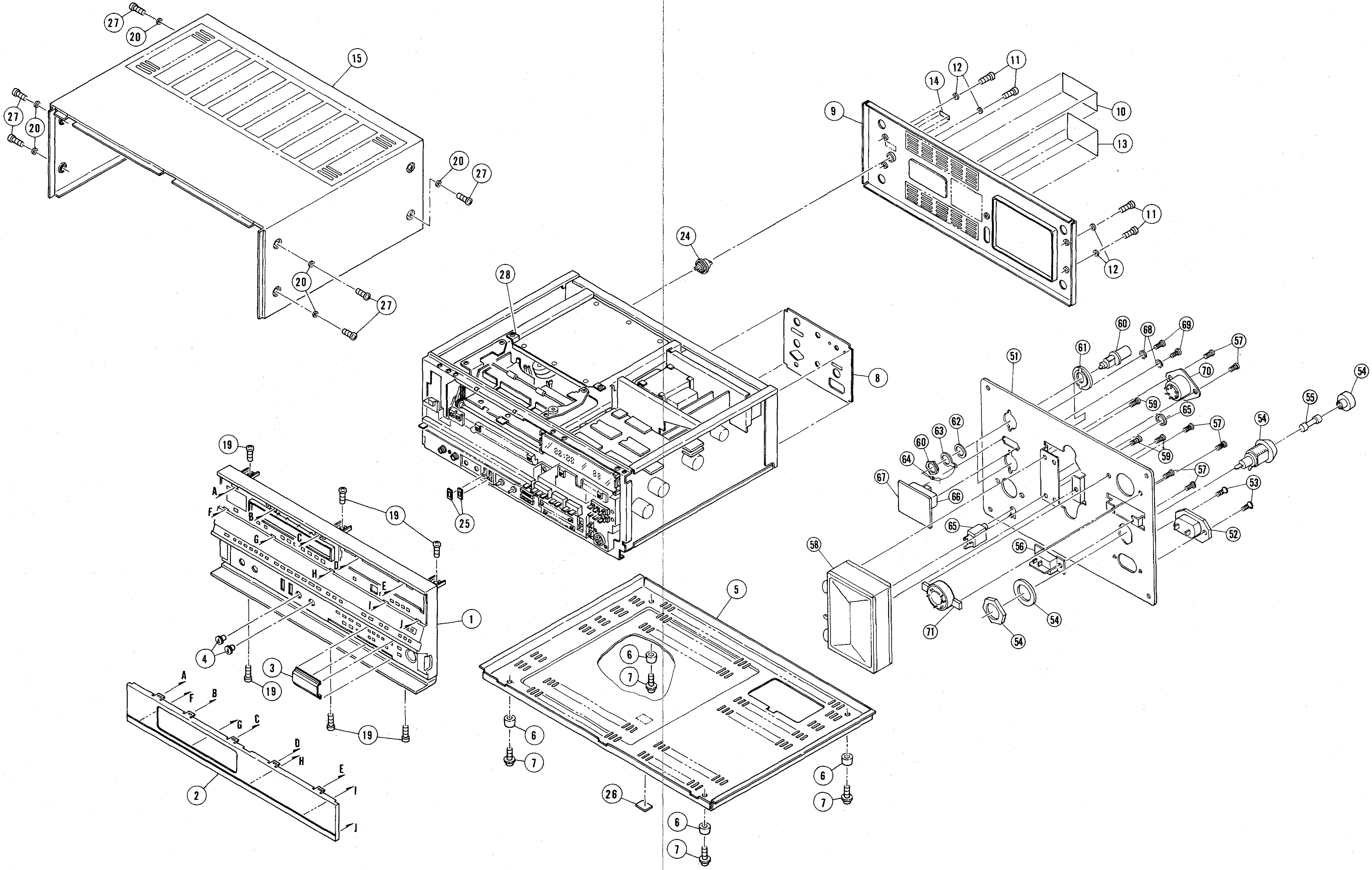
7.2 PACKING ASSEMBLY LIST M1

Symbol No.	Part No.	Part Name	Description	Q'ty
1	PUP40324-5	Poly Bag		1
2	PUP10109	Rear Cushion		1
3	PUP10108	Front Cushion		1
4	PUP30467	Protector		1
5	PUP30465	Packing Case		1
6	PUP40329	Serial No. Sticker		2
7	PUP40503-2	Sheet		1

7.3 ACCESSORY LIST M2

Symbol No.	Part No.	Part Name	Description	Q'ty
8	PU30425-323	Instruction Book (English)	EG only	1
	〃 -364	〃 (German)	EG only	1
	〃 -365	〃 (French)	EG only	1
	〃 -337	〃	EK only	1
	PU32004	Guaranty Card	EK only	1
9	QPGA025-03505	Poly Bag		1
⚠ 10	QMP3950-183	Power Cord with Plug	EG only	1
⚠	PU46128-BS	Power Cord	EK only	1
⚠ 11	PU43294F	Aerial Cable Ass'y		1
⚠ 12	PU49477	Remote Control Unit	EG only	1
⚠	PU49477-2	〃	EK only	1
13	PTE-30	Video Cassette		1
14	UM-3HJ	Battery		4
15	QPGA020-03005	Poly Bag		1

7.4 CABINET ASSEMBLY M3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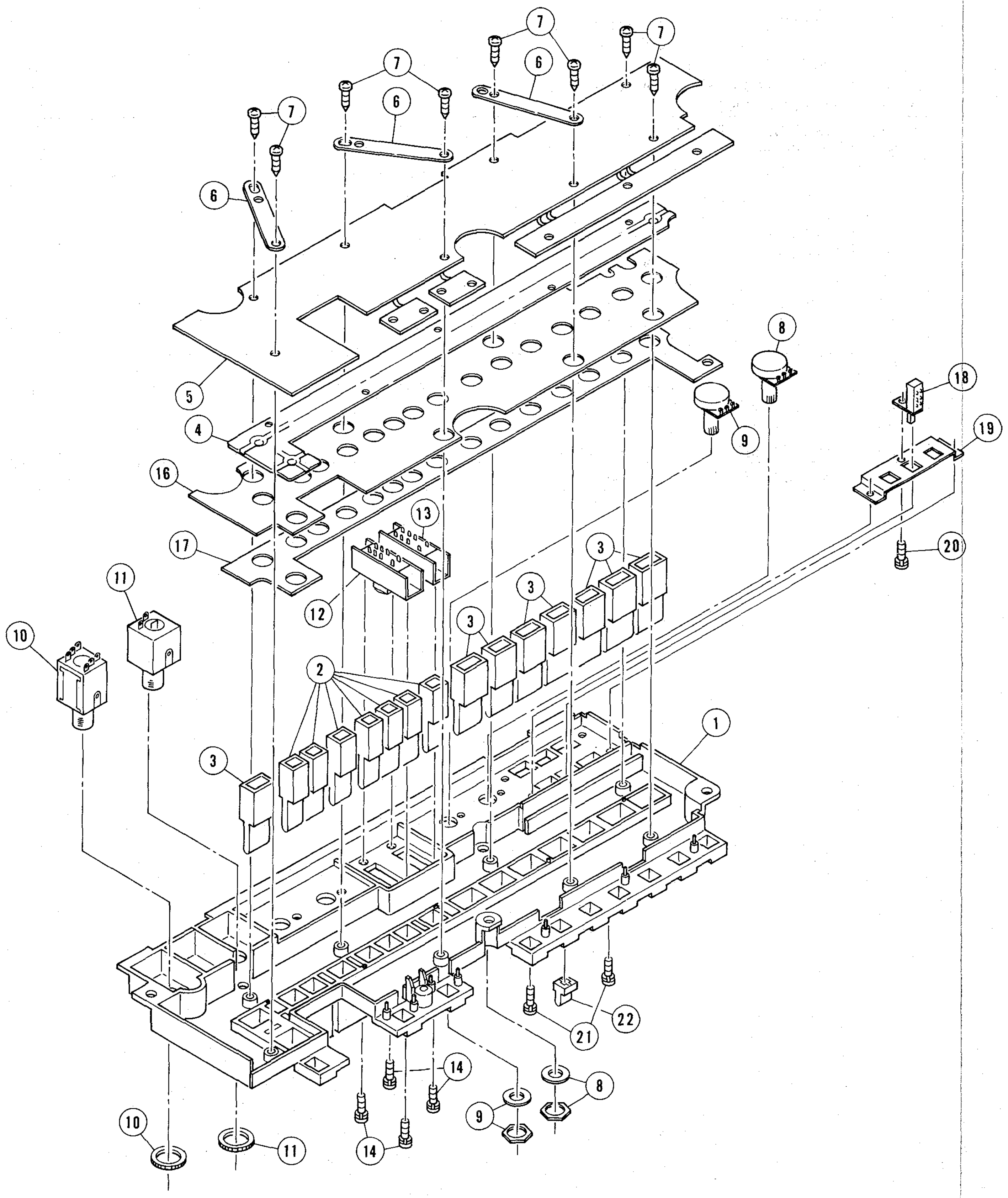
7.4 CABINET ASSEMBLY LIST M3

Symbol No.	Part No.	Part Name	Description	Q'ty
1	PU10277A	Front Panel Ass'y	EG only Incl: ③	1
	PU10277B	"	EK only	1
2	PU20965	Indicator Glass		1
3	PU49264	Slide Cover		1
4	PU49652	Knob		2
5	PU10286	Bottom Cover		1
6	QZF2010-002	Foot		4
7	GPST3008ZS	Tap. Screw		4
8	PU32570	Terminal Sheet		1
9	PU20986	Rear Cover		1
10	PU32612	Serial No. Plate	EG only	1
	PU32612-2	"	EK only	1
11	SDST3006MS	Tap. Screw		4
12	WSS3000M	Washer		4
13	PU49714	Caution Label	EG only	1
	PU49713	"	EK only	1
14	PU49716	Sticker		1
15	PU10285	Top Cover		1
16	–	–		–
17	–	–		–
18	–	–		–
19	SDST3005RS	Tap. Screw		6
20	WSB3000N	Washer		6
21	–	–		–
22	–	–		–
23	PU49765-2	Sticker	EK only	1
24	PU49590	Knob		1
25	PU49265	SW. Washer		2
26	PU48093	Label	(DOLBY)	1
27	SDST3006RS	Tap. Screw		6
28	PU32683A	Shield Plate Ass'y		1

TERMINAL ASS'Y M3

Symbol No.	Part No.	Part Name	Description	Q'ty
51	PU32553	Terminal Bracket		1
⚠ 52	QMC9017-001-BS	AC Connector		1
53	SSSP3006ZS	Screw		2
⚠ 54	QMG0301-003-BS	Fuse Holder		1
⚠ 55	QMF51A2-1R6-BS	Fuse	F1	1
⚠ 56	QSE2135-002-BS	Seesaw Switch		1
57	LPSP3006ZS	Screw		6
⚠ 58	PU49720	Booster	EG only	1
	PU49721	"	EK only	1
59	LPSP3005ZS	Screw		3
60	PU48567	BNC Connector		2
61	PU48611	Ring		2
62	Q03093-439	Washer		2
63	PU43344	Earth Lug		2
64	QRD181J-750	Carbon Resistor		1
65	QMS3501-009	Jack Ass'y		1
66	–	–		–
67	–	Switch Board Ass'y	REF: 3 1	1
68	WLS2600N	Lock Washer		2
69	SPSP2604Z	Screw		2
70	QMC0589-001	DIN Connector		1
⚠ 71	QSR0085-002BS	Voltage Selector		1

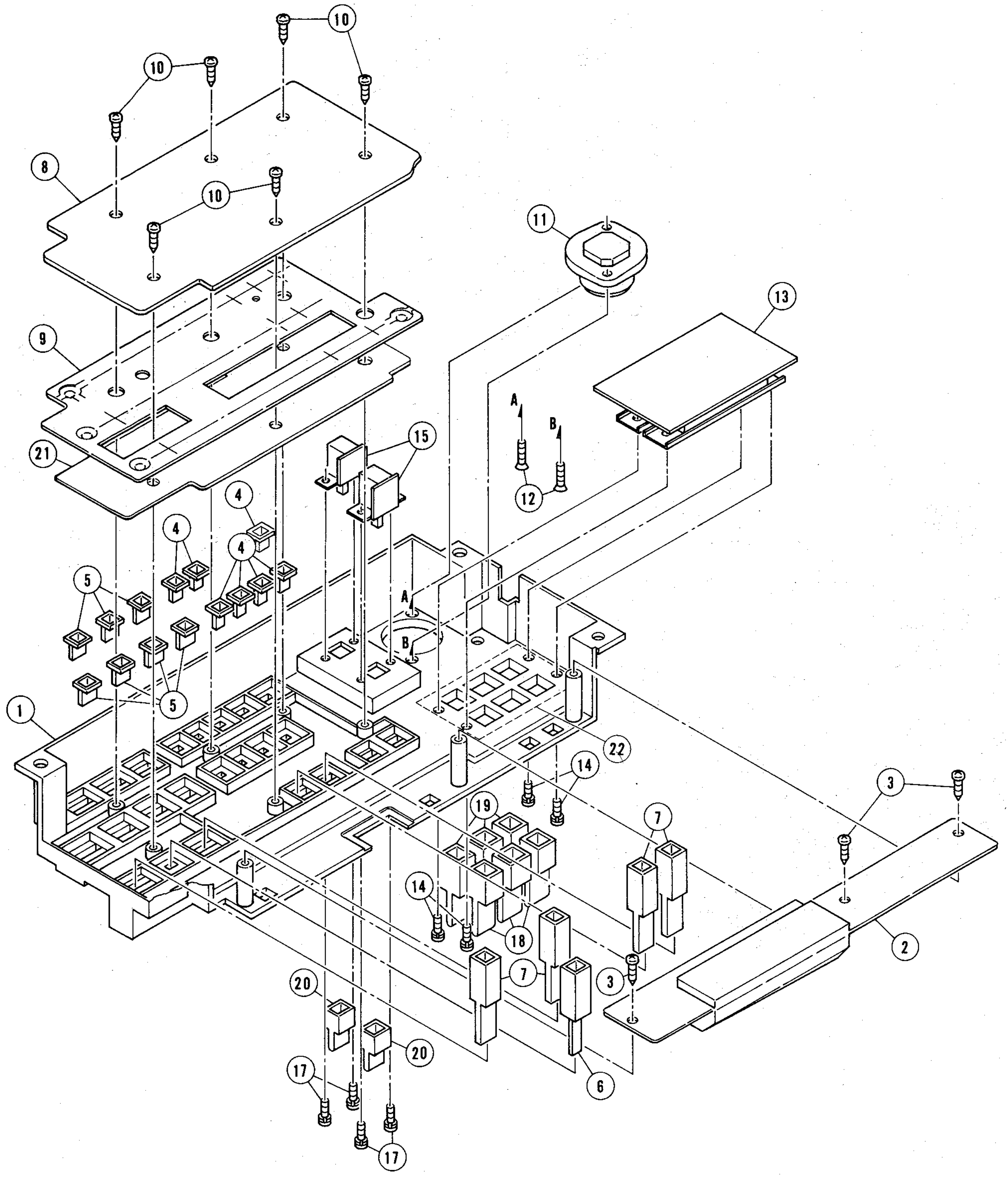
7.5 OPERATION UNIT(A) ASSEMBLY $\boxed{M}\boxed{4}$



7.5 OPERATION UNIT(A) LIST $\boxed{M}\boxed{4}$

Symbol No.	Part No.	Part Name	Description	Q'ty
1	PU20959	Mounting Base (A)		1
2	PU49270	Push Knob (D)		7
3	PU49271	〃 (E)		8
4	PU49399	Switching Rubber (A)		1
5	–	Key Search Circuit Board Ass'y	REF: $\boxed{2}\boxed{4}$	1
6	PU49491	Wire Clamp		3
7	SDSA2608Z	Tap. Screw		8
8	QVF1A6B-155V	V. Resistor	R6	1
9	QVF1A6B-1F5V	〃	R7	1
10	QMS6304-012	Jack Ass'y	Head Phone	1
11	QMS6303-003	〃	Mic	1
12	QSS2324-004	Slide Switch	S1	1
13	QSS2324-004	〃	S2	1
14	LPSP2606Z	Screw		4
15	–	–		–
16	PU32720	Sheet (A)		1
17	PU32777	Sheet (B)		1
18	QSP2210-075	Push Switch	S3	1
19	PU49871	SW. Bracket		1
20	LPSP2606Z	Screw		1
21	LPSP3006ZS	〃		2
22	PU49274	Push Knob (H)		1

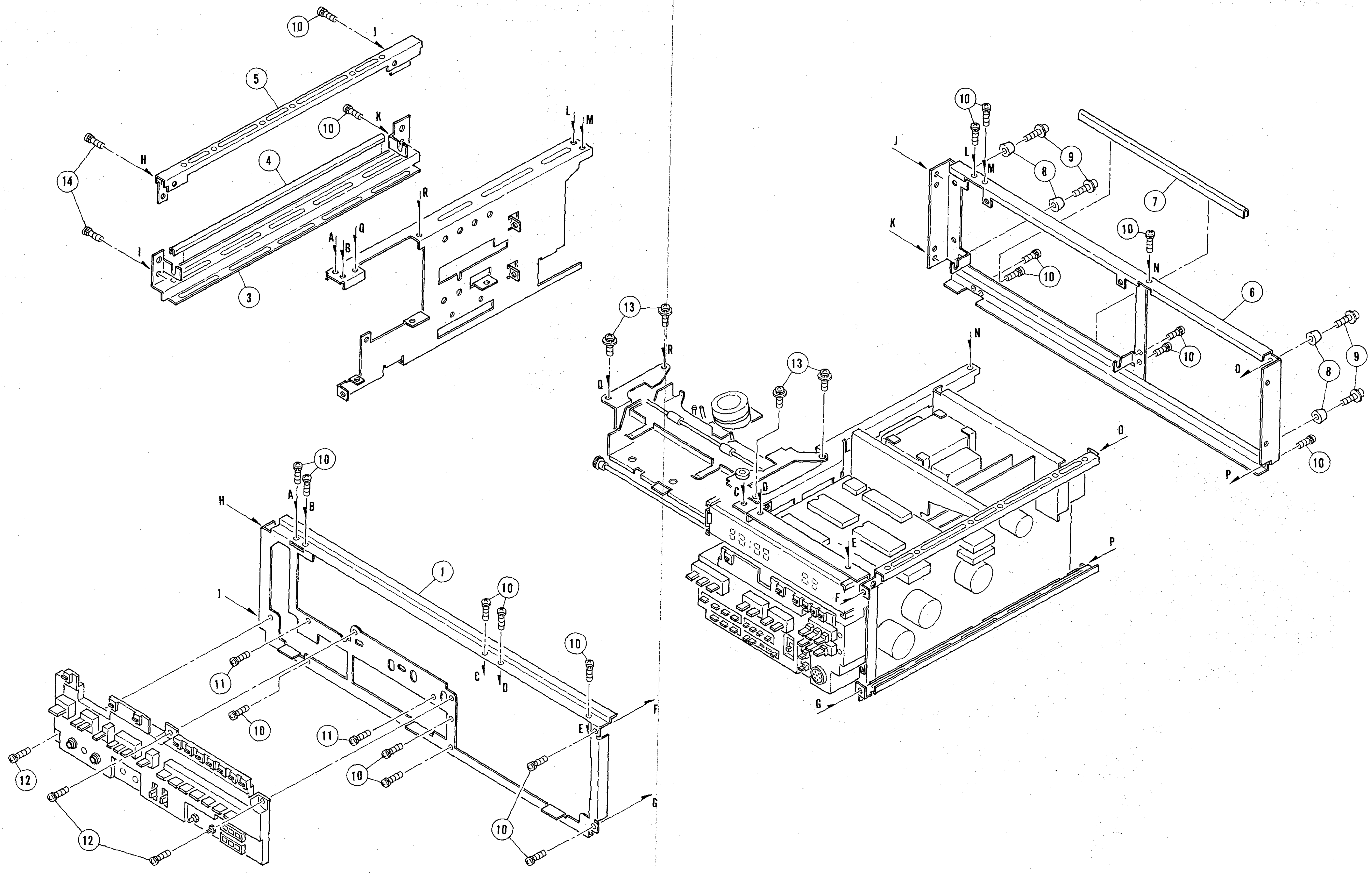
7.6 OPERATION UNIT(B) ASSEMBLY M5



7.6 OPERATION UNIT (B) LIST M5

Symbol No.	Part No.	Part Name	Description	Q'ty
1	PU20960	Mounting Base (B)		1
2	—	IFR Receiver Circuit Board Ass'y	REF: 36	1
3	SDSA3010Z	Tap. Screw		3
4	PU49267	Push Knob (A)		7
5	PU49268	″ (B)		7
6	PU49269	″ (C)		1
7	PU49270	″ (D)		4
8	—	Key Search Circuit Board Ass'y	REF: 35	1
9	PU49400	Switching Rubber (B)	Incl:⑧ Key Search Circuit Board Ass'y	1
10	SDSA2608Z	Tap. Screw		6
11	PU49398A	Camera Connector Ass'y		1
12	SSSP3008ZS	Screw		2
13	—	Switch Circuit Board Ass'y	REF: 33	1
14	DPSP3010ZS	Screw		4
15	—	Push Switch Circuit Board Ass'y	REF: 34	1
16	—	—		—
17	LPSP2008Z	Screw		4
18	PU49272	Push Knob (F)		3
19	PU49273	″ (G)		3
20	PU49274	″ (H)		2
21	PU50048	Sheet (B)		1
22	PU50255	Sheet		1

7.7 CHASSIS ASSEMBLY M6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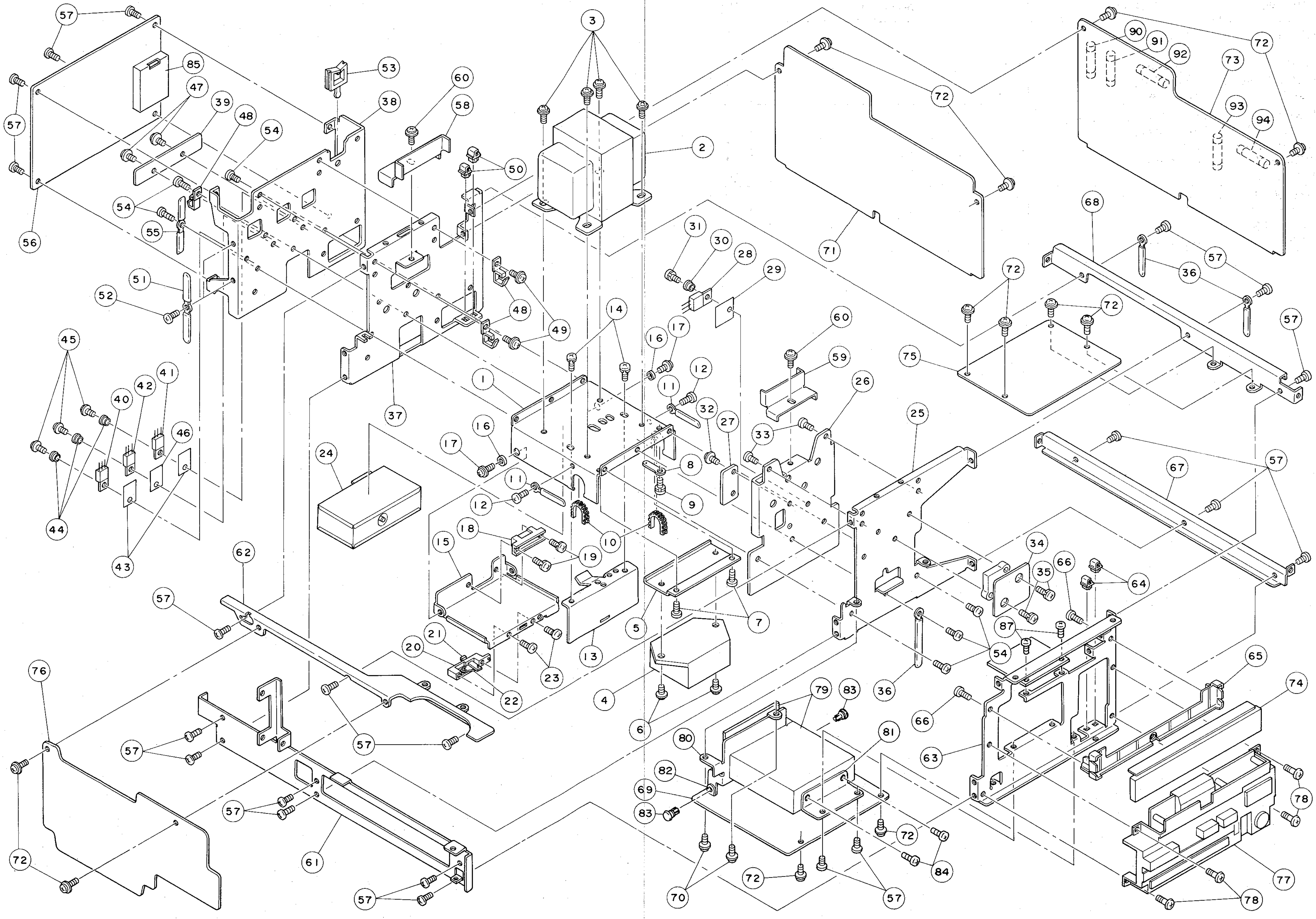
7.7 CHASSIS ASSEMBLY PART LIST M6

Symbol No.	Part No.	Part Name	Description	Q'ty
1	PU20982	Front Frame		1
2	–	–		–
3	PU32558	Lower Stay	Left Side	1
4	PU43135-1-286	Nylon Edging		1
5	PU32559	Upper Stay	Left Side	1
6	PU20983	Rear Frame		1
7	PU43135-1-234	Nylon Edging		1
8	QZF1514-001μA	Foot		4
9	GPST3008ZS	Tap. Screw		4
10	SPST3006ZS	″		20
11	LPSP3006ZS	Screw		2
12	PU49275	″		3
13	DPSP3006ZS	″		4
14	SSST3006ZS	Tap. Screw		2

7.8 TUNER UNIT ASSEMBLY M7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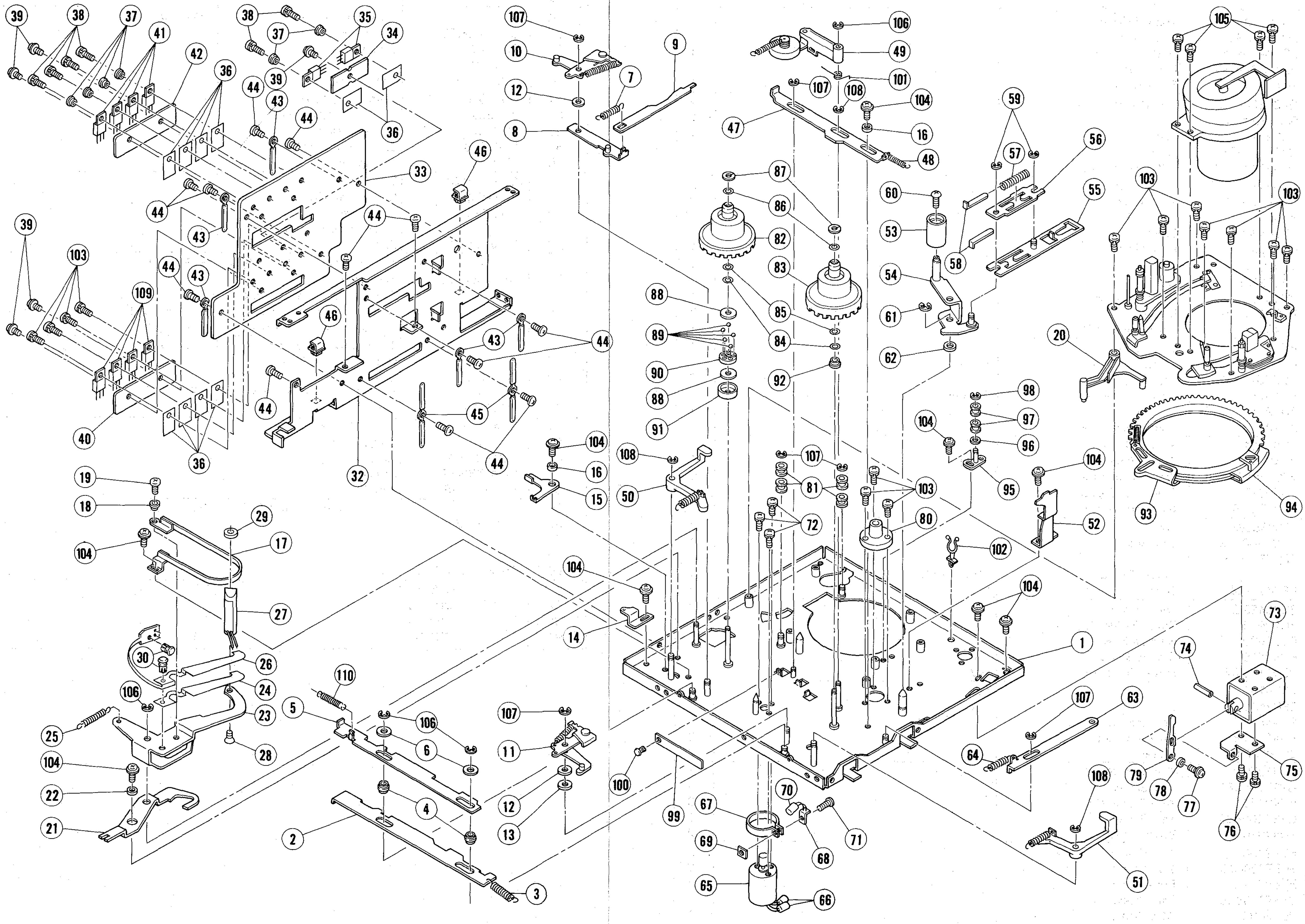
7.8 TUNER UNIT ASSEMBLY PART LIST M7

Symbol No.	Part No.	Part Name	Description	Q'ty
1	PU32549	Trans. Bracket		1
⚠ 2	PU49448BS	Power Trans.		1
3	DPSP4006ZS	Screw		4
⚠ 4	PU49371A-BS	Line Filter		1
5	PU49433	Filter Holder		1
6	GPST3006ZS	Tap. Screw		2
7	SPST3006ZS	"		2
8	A50221	Lug		1
9	LPSP4006ZS	Screw		1
10	PU43172-1-50	Nylon Grommet		2
11	PU49485-1	Wire Clamp		2
12	SPST3006ZS	Tap. Screw		2
13	PU32551	RF Holder		1
14	LPSP3006ZS	Screw		2
15	PU32552	RF Holder (B)		1
16	T30302-5	Collar		2
17	DPSP3006ZS	Screw		2
18	PU45160	RF Connector		1
19	LPSP3008ZS	Screw		2
20	PU49591	Lock Lever Guide		1
21	PU49593	Lock Lever		1
22	PU49595	Torsion Spring		1
23	SDBA2606M	Tap. Screw		2
⚠ 24	PU49719	RF Converter	EG only	1
	PU49718	"	EK only	1
25	PU20978	Trans. Holder (A)		1
26	PU32554	Heat Sink (A)		1
27	PU49443	Circuit Board	28	1
28	2SC2484P	Power Transistor	X1	1
29	PU45375-4	Transistor Spacer		1
30	PU41624-6	Isolation Washer		1
31	LPSP3008ZS	Screw		1
32	GPST3006ZS	Tap. Screw		1
33	SPST3006ZS	"		2
34	–	Circuit Board	REF: 29	1
35	LPSP3012ZS	Screw		2
36	PU49485-2	Wire Clamp		3
37	PU20979	Trans. Holder (B)		1
38	PU20980	Heat Sink (B)		1
39	PU49445	Circuit Board	30	1
40	2SD1128-02	Power Transistor	X2	1
41	2SD476C	"	X3	1
42	2SC2484P	"	X4	1
43	PU45375-3	Transistor Spacer		2
44	PU41624-6	Isolation Washer		3
45	LPSP3008ZS	Screw		3
46	PU45375-4	Transistor Spacer		1
47	GPST3006ZS	Tap. Screw		2
48	PU49472	Wire Saddle (1)		3
49	GPST3008ZS	Tap. Screw		2
50	PU47876	Board Holder		2
51	PU49486	Wire Clamp		2
52	SPST3006ZS	Tap. Screw		2
53	PU49881	Edge Cover		1
54	SPST3008ZS	Tap. Screw		6
55	PU49486	Wire Clamp		1
56	–	Terminal Ass'y	REF: M3	1
57	SPST3006ZS	Tap. Screw		21
58	PU49434	Gripper		1
59	PU49791	"		1
60	GPST3006ZS	Tap. Screw		2
61	PU20976	Center Stay (Low)		1
62	PU32555	" (Upper)		1
63	PU20977	Front Bracket		1
64	PU47876	Circuit Board Holder		2
65	PU32520	Display Holder		1
66	SDSA3012Z	Tap. Screw		2
67	PU32556	Lower Stay (R)		1
68	PU32557	Upper Stay (R)		1
69	–	IF Circuit Board Ass'y	REF: 11	1
70	LPSP3006ZS	Screw		2
71	–	T/T Cont. Circuit Board Ass'y	REF: 09	1
72	GPST3006ZS	Tap. Screw		12
73	–	Power Supply Circuit Board Ass'y	REF: 10	1
74	–	Display Holder Circuit Board Ass'y	REF: 22	1
75	–	Display Circuit Board Ass'y	REF: 08	1
76	–	Junction Circuit Board Ass'y	REF: 07	1
77	–	Operation Unit (B) Ass'y		1
78	PU49275	Screw		4
79	–	Tuner Circuit Board Ass'y	REF: 45	1
80	PU32688	Tuner Holder (A)		
81	PU49435	Tuner Holder (W, B)		
82	PU49437	Hinge Foot		2
83	E48729-001	Plastic Rivet		2
84	LPSP3004ZS	Screw		2
85	PU49918-BS	Barrier		1
86	–	Back up Circuit Board Ass'y	REF: 46	1
87	GPST3006ZS	Screw		2
88	–	–		–
89	–	–		–
⚠ 90	QMF51A2-R40-BS	Fuse	F6	1
⚠ 91	" -1R6-BS	"	F3	1
⚠ 92	" -2R5-BS	"	F2	1
⚠ 93	" -3R15-BS	"	F5	1
⚠ 94	" -2R0-BS	"	F4	1

7.9 MAIN DECK-1 M8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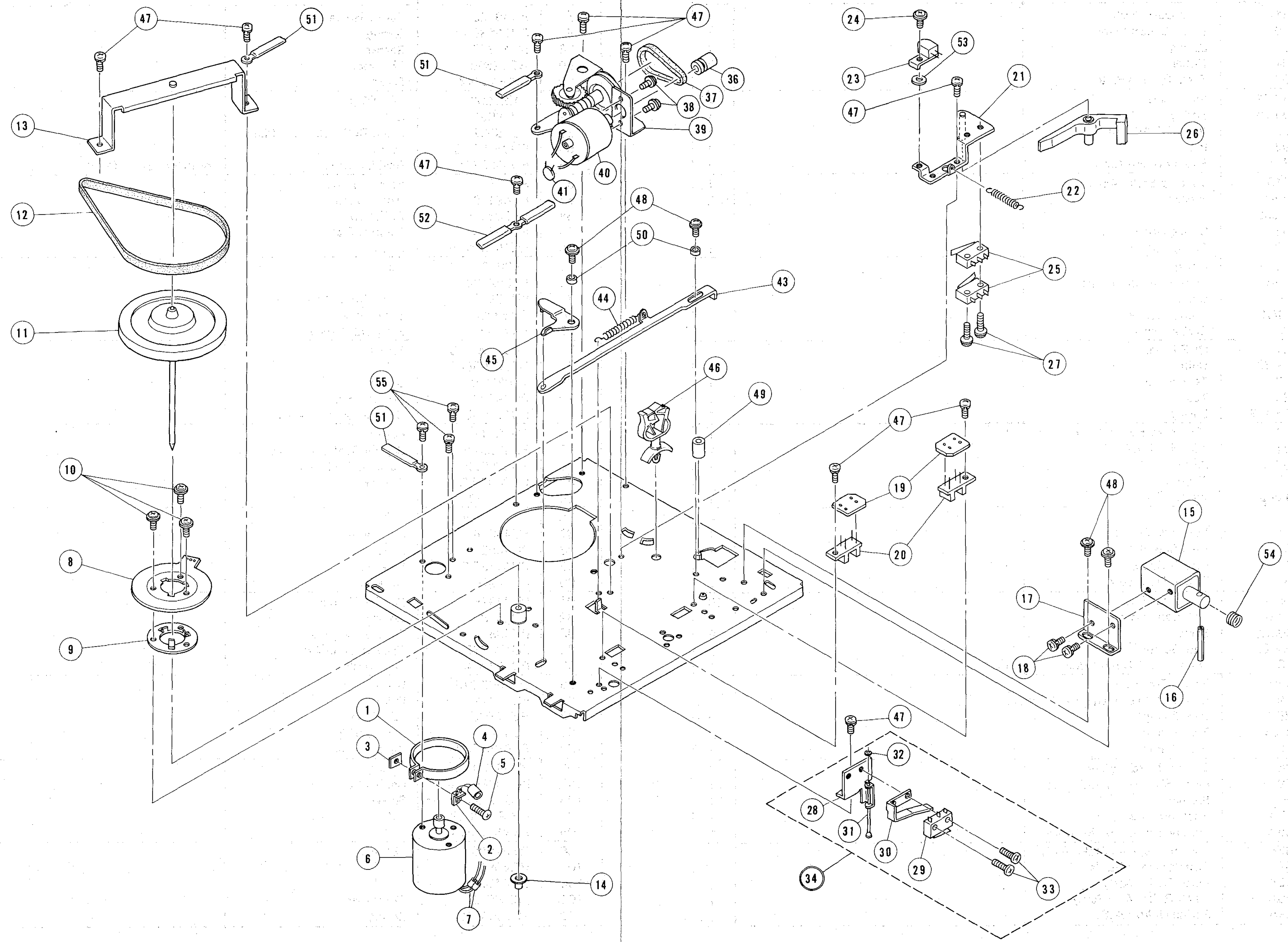
7.9 MAIN DECK-1 LIST M 8

Symbol No.	Part No.	Part Name	Description	Q'ty
1	PU20931A	Main Deck Ass'y		1
2	PU48879	Brake Cancel Plate		1
3	T30300-156	Spring		1
4	PU48894	Roller		2
5	PU48893	Back Tension Plate		1
6	Q03093-101	Slit Washer		2
7	PU35005-28	Spring		1
8	PU48890	Idler Off Arm Ass'y		1
9	PU48892	Plate		1
10	PU48884A	Supply Brake Ass'y		1
11	PU48884B	Take-up Brake Ass'y		1
12	Q03093-817	Washer		2
13	" -503	"		1
14	PU48966	Spring Hook		1
15	PU48880	Change Lever		1
16	PU43769-15	Collar		2
17	PU48899A	Tension Band Curling		1
18	PU48906	Collar		1
19	SPSP2004Z	Frange Screw		1
20	PU48895	Cancel Lever		1
21	PU48964	OFF Lever		1
22	PU43769-33	Collar		1
23	PU48898	Tension Arm		1
24	PU50029	Tape		1
25	PU35005-118	Spring		1
26	PU32710	"Q" Head Board Ass'y	1 5	1
27	PU49654	"Q" Head Ass'y		1
28	SSSP2605Z	Screw		1
29	PU50258	Tube		1
30	E48729-009	Plastic Rivet		2
31	–	–		–
32	PU20981	Left Side Frame		1
33	PU32561	Heat Sink (C)		1
34	PU49444	Circuit Board	1 4	1
35	2SD476C	Power Transistor		2
36	PU45375-3	Transistor Spacer		10
37	PU41624-6	Isolation Washer		6
38	LPSP3008ZS	Screw		6
39	SPST3006ZS	Tap. Screw		5
40	PU49478	Drum P. TR. Circuit Board	1 3	1
41	2SC1983R	Power Transistor		4
42	PU49479	Capstan Power Transistor P.C. Board	1 2	1
43	PU49485-1	Wire Clamp		5
44	SPST3006ZS	Tap. Screw		12
45	PU49486	Wire Clamp		2
46	PU47876	Circuit Board Holder		2
47	PU48926	Pinch Roller Arm Push Plate		1
48	T30300-114	Spring		1
49	PU48967A	Reel Idler Ass'y		1
50	PU48965A	Supply Tension Brake Ass'y		1
51	PU48965B	Take-up Tension Brake Ass'y		1
52	PU48957	Cassette Door Guide		1
53	PU47549A	Pinch Roller Ass'y		1
54	PU48928A	Pinch Roller Arm Ass'y		1
55	PU49189A	Spring Holder Ass'y		1
56	PU49528	Spring Holder		1
57	PU30080-71	Spring		1
58	PU47327	Spacer		2
59	REE2500	"E" Ring		2
60	LPSP2604Z	Screw		1
61	REE5000	"E" Ring		1
62	PU48931	Collar		1
63	PU48927	Pinch Roller Connect Plate		1
64	PU35005-18	Spring		1
⚠ 65	PU48922-V	Reel Motor Ass'y	or PU48922-S, -M, -P	1
66	PU45811	Ferrite Beads		2
67	PU49159	Motor Band		1
68	V03082-2	F. T. Cap		1
69	PU43730	Tapping Plate		1
70	QEN41HM-105	E. Cap		1
71	LPSP3010ZS	Screw		1
72	LPSP2004Z	"		3
73	PU48933	Pinch Roller Solenoid		1
74	PRE3008	Spring Pin		1
75	PU49521	Solenoid Bracket		1
76	LPSP3004ZS	Screw		2
77	DPSP3006ZS	"		1
78	T30302-9	Collar		1
79	PU49193	Connect Plate		1
80	PU47205B	Capstan Bearing Ass'y		1
81	PU48711	Pulley		4
82	PU48907A	Supply Reel Disk Ass'y		1
83	PU48907B	Take-up Reel Disk Ass'y		1
84	Q03093-828	Washer		2
85	" -834	"		2
86	" -827	"		2
87	PU48868	Slit Washer		2
88	PU44921	Spacer		2
89	PU41135-3	Steel Ball		5
90	PU44920	Retainer		1
91	PU44919	Bearing Holder		1
92	PU45789	Collar		1
93	PU48837B	Supply Ring Ass'y		1
94	PU48838B	Take-up Ring Ass'y		1
95	PU48708A	Plate Ass'y		1
96	Q03093-819	Washer		1
97	PU48711	Pulley		2
98	REE3000	"E" Ring		1
99	PU49588	Plate Spring		1
100	E48729-009	Plastic Rivet		1
101	PU48920	Spring		1
102	PU49649	Cable Clip		1
103	LPSP3006ZS	Screw		14
104	DPSP3006ZS	"		10
105	LPSP3010ZS	"		4
106	REE2500	"E" Ring		4
107	REE3000	"		6
108	REE4000	"		3
109	2SB772QR	Transistor		4
110	PU35005-80	Spring		1

7.10 MAIN DECK-2 M9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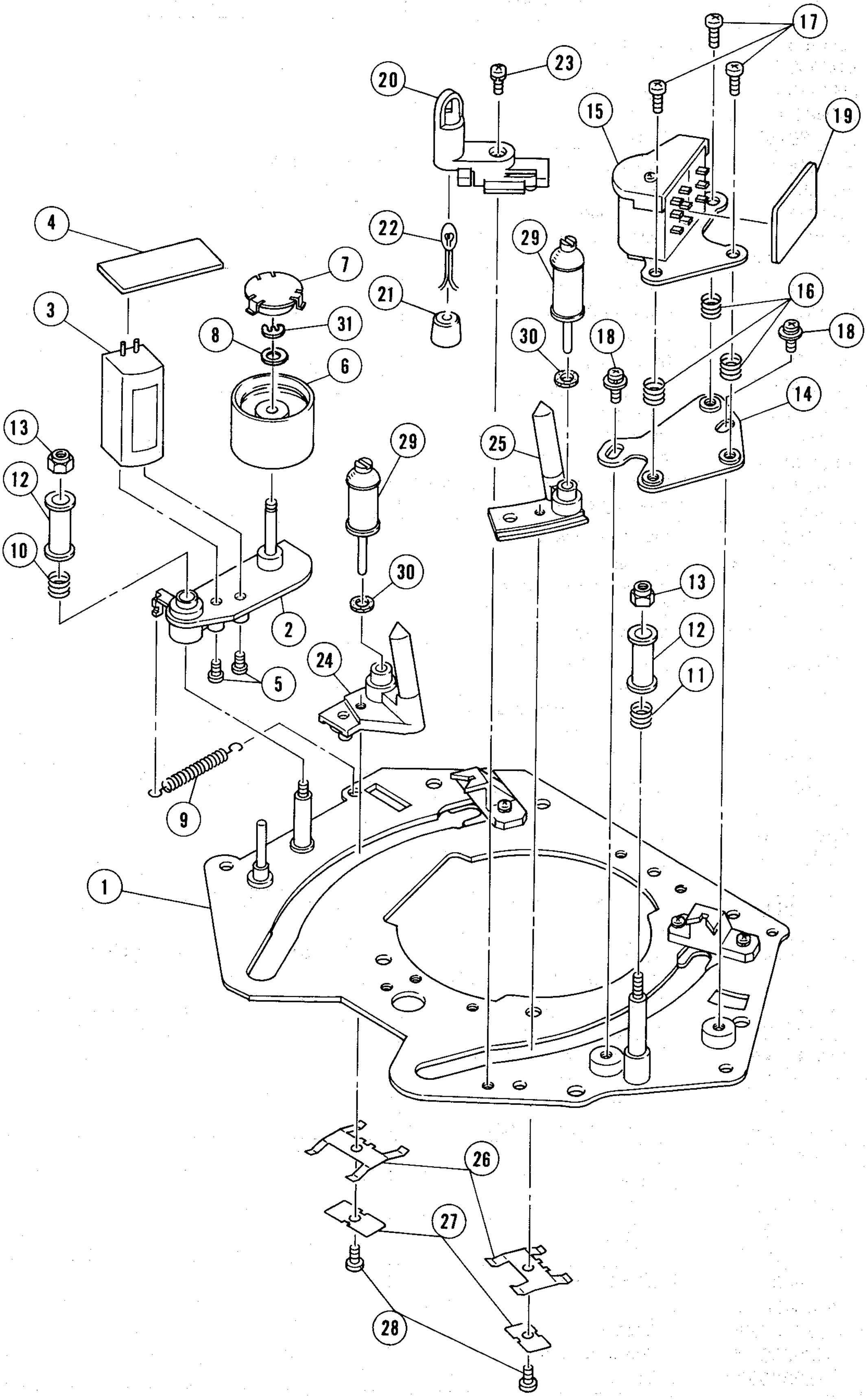
7.10 MAIN DECK-2 LIST M 9

Symbol No.	Part No.	Part Name	Description	Q'ty
1	PU45980	Capstan Motor Band		1
2	V03082-2	F. T. Cap		1
3	PU43730	Tapping Plate		1
4	QEN41HM-105	E Cap		1
5	LPSP3010ZS	Screw		1
⚠ 6	PU49162S	Capstan Motor Ass'y	or PU49162M, PU49162P	1
7	PU45811	Ferrite Beads		2
8	PU49169	F. G. Board	2 0	1
9	PU49170	Board Holder		1
10	DPSP3006ZS	Screw		3
11	PU32497A	Flywheel Ass'y		1
12	PU49164	Capstan Belt		1
13	PU49171A	Bracket Ass'y		1
14	PU47209	Shield Cap		1
15	PU48882	Main Solenoid		1
16	PRE3028	Spring Pin		1
17	PU48883	Bracket		1
18	LPSP3004ZS	Screw		2
19	PU48950	Photo Detector Circuit Board	2 3	1
20	PS4009	Photo Detector		2
21	PU48952A	Switch Bracket Ass'y		1
22	PU35005-119	Spring		1
23	PU49151	Pick-up Head Ass'y		1
24	DPSP3006ZS	Screw		1
25	QSM1S11-201	Microswitch		2
26	PU48955	Switch Lever		1
27	SPBP2316N	Screw		2
28	PU48960	Cassette Switch Bracket		1
29	QSM1S01-014	Microswitch		1
30	PU48969	Leaf Spring		1
31	PU48961-2	Shaft	㉞ Cassette Switch Bracket Ass'y	1
32	PU48868-2	Slit Washer		1
33	SPBP2310N	Screw		2
34	PU48959A	Cassette Switch Bracket Ass'y		1
35	—	—		—
36	PU48852A	Motor Pulley Ass'y	Incl: Set Screw (YWS3003PS)	1
37	PU48941-2	Belt		1
38	LPSP2604Z	Screw	㊷ Loading Drive Gear Ass'y	2
39	PU49815A	Drive Gear Bracket Ass'y		1
⚠ 40	PU48854	Loading Motor		1
41	QCF11HP-473	C Cap		1
42	PU48925A	Loading Drive Gear Ass'y		1
43	PU48935	Cancel Plate		1
44	PU35005-123	Spring		1
45	PU48936A	Connect Lever Ass'y		1
46	PU50259	Stand of Clip		1
47	LPSP3006ZS	Screw		14
48	DPSP3006ZS	"		4
49	PU48968	Collar		1
50	PU43769-15	"		2
51	PU49485	Wire Clamp		3
52	PU49486	"		1
53	Q03095-205	Washer		1
54	PU30080-74	Comp. Soring		1
55	DPSP3005Z	Screw		3

7.11 SUB DECK M 10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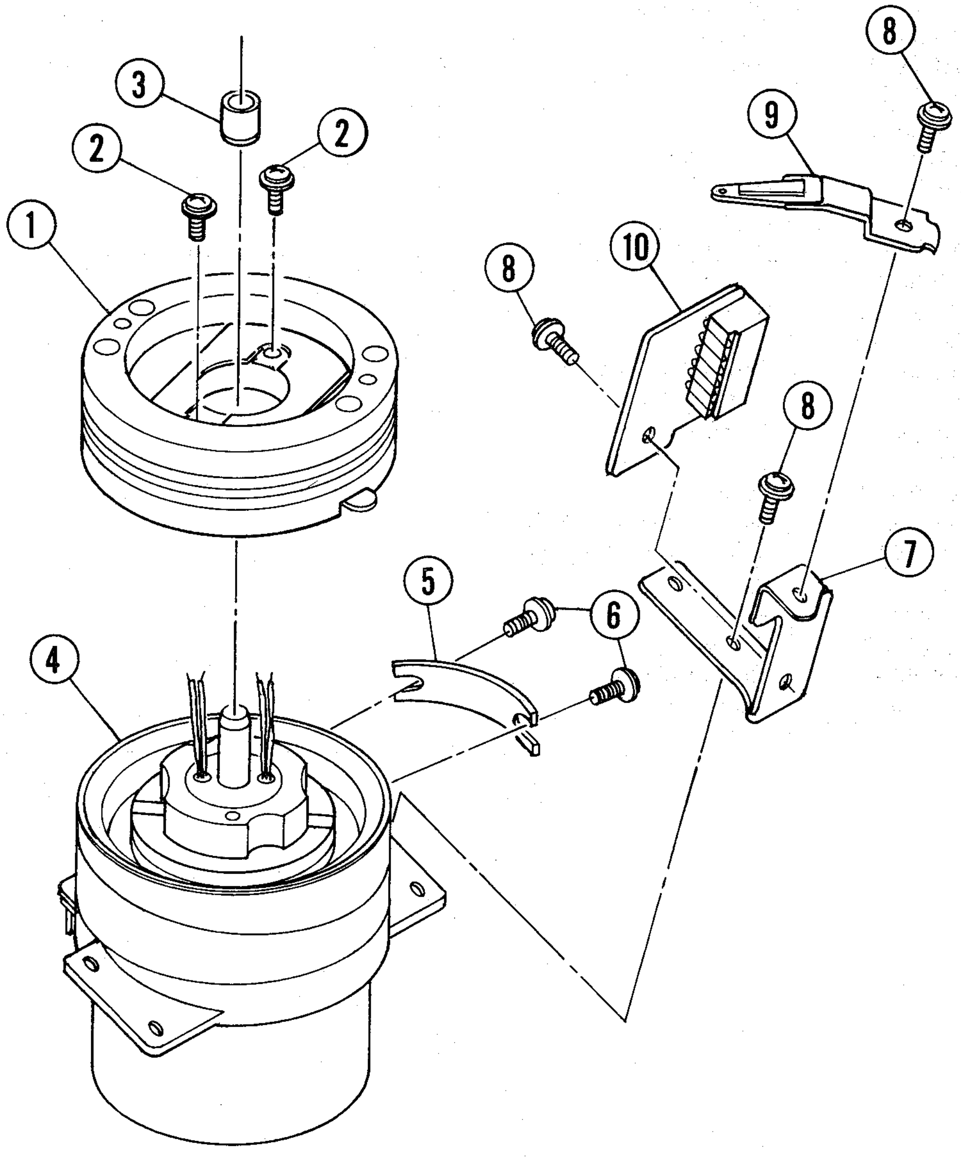
7.11 SUB DECK LIST M 10

Symbol No.	Part No.	Part Name	Description	Q'ty
1	PUS46182A	Sub Deck Sub Ass'y		1
2	PU49555A	Erase Head Arm Sub Ass'y		1
3	PU47863	Full Erase Head		1
4	PU50117	Full Erase Head Circuit Board	1 9	1
5	LPSP2004Z	Screw		2
6	PU48079A	Roller Ass'y		1
7	PU47819	Thrust Bearing		1
8	Q03093-830	Washer		1
9	T30300-004	Spring		1
10	PU30080-69	"		1
11	PU30080-49	"		1
12	PU48733	Guide Pole		2
13	PU49276	Nylon Nut		2
14	PU48734	Base		1
15	PU49556M	A/CTL Head Ass'y		1
16	PU30080-49	Spring		3
17	SPSP3008ZS	Screw		3
18	DPSP3006ZS	"		2
19	PU46436	A/CTL Head Board	1 6	1
20	PU48737	Lamp Holder		1
21	PU44894	Stopper		1
22	PU49557	Cassette Lamp		1
23	LPSP3006ZS	Screw		1
24	PU48740A	Supply Pole Base Ass'y		1
25	PU48745A	Take-up Pole Base Ass'y		1
26	PU48747	Spring Plate		2
27	PU49822	Plate		2
28	SDSP2606Z	Screw		2
29	PU48748A	Guide Roller Ass'y		2
30	PU48806-3	Rubber Tire		2
31	REE1500	"E" Ring		1

7.12 DRUM ASSEMBLY M11



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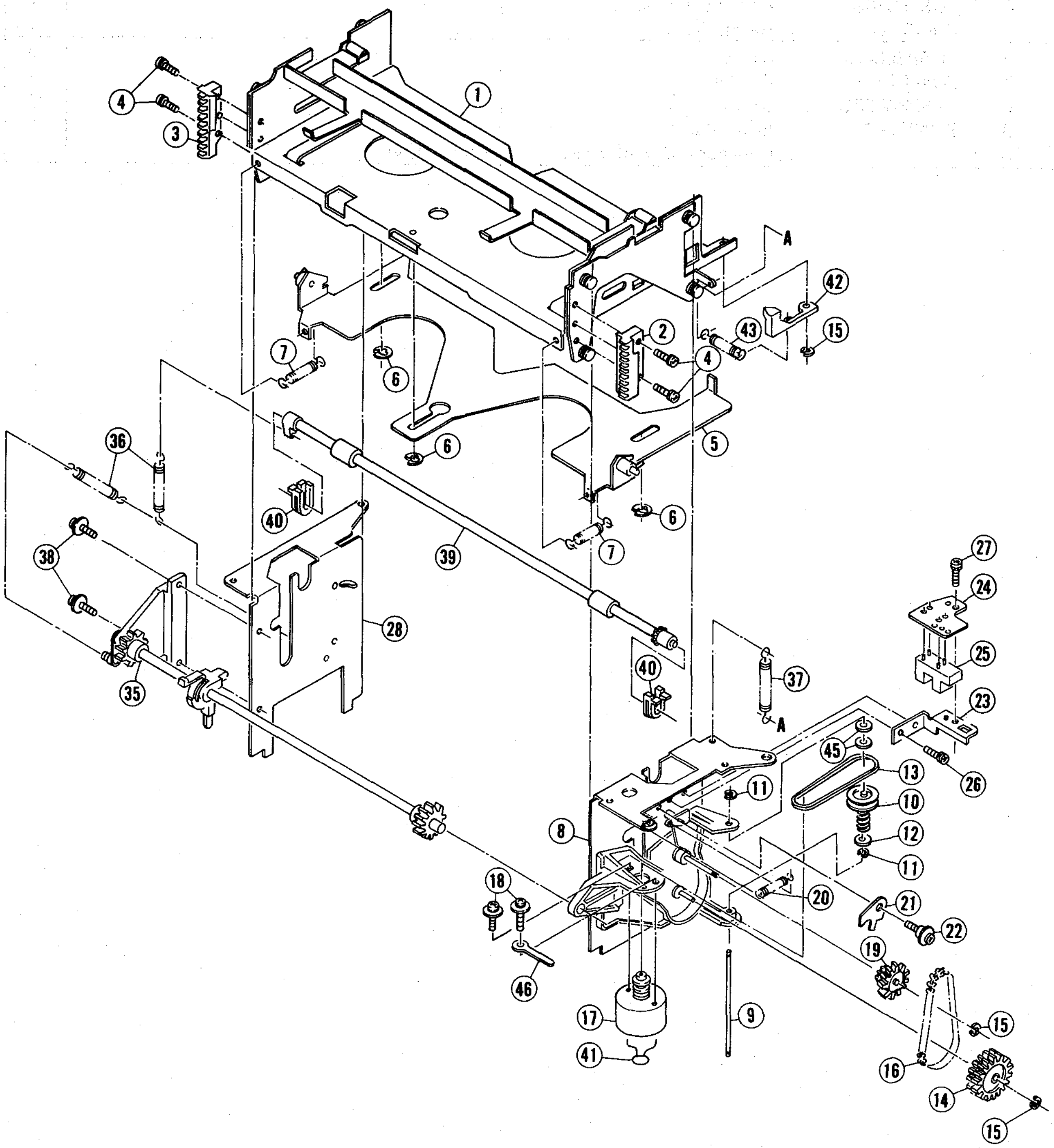
7.12 DRUM ASSEMBLY LIST M11

Symbol No.	Part No.	Part Name	Description	Q'ty
1	PU31332F-11	Upper Drum Ass'y		1
2	NDSP3010NS	Screw		2
3	PU49483	Commutator		1
⚠ 4	PUS25978B	Lower Drum Ass'y		1
5	PU48700	Heater Ass'y		1
6	SDBP3004NS	Screw		2
7	PU48677	Bracket		1
8	DPSP3006ZS	Screw		3
9	PU48678A	Brush Ass'y		1
10	–	Connector Circuit Board	REF: 18	1

7.13 CASSETTE HOUSING ASSEMBLY M12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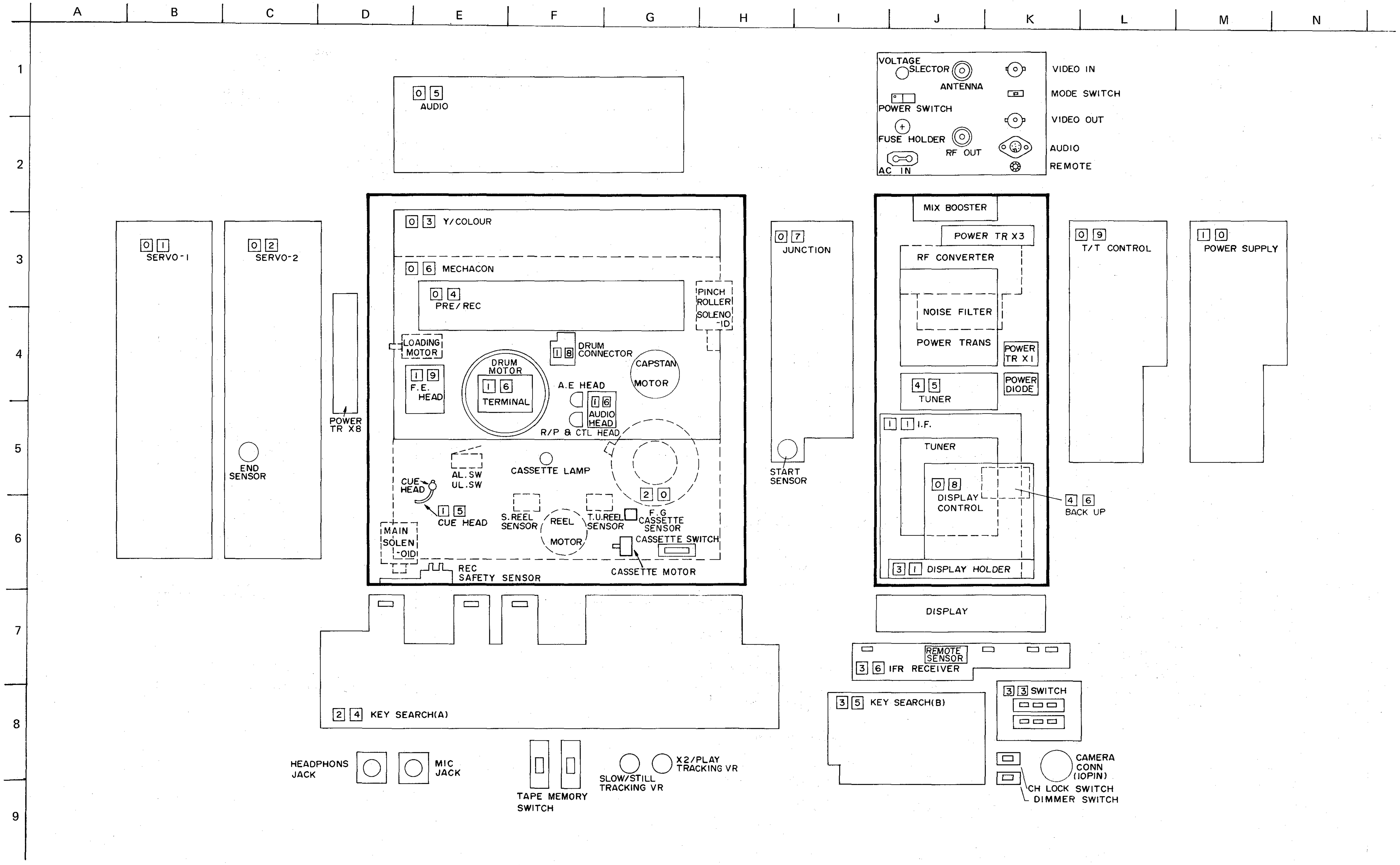
7.13 CASSETTE HOUSING ASSEMBLY LIST M 12

Symbol No.	Part No.	Part Name	Description	Q'ty
1	PU20934A	Cassette Housing Sub Ass'y		1
2	PU49015	Rack Gear (R)		1
3	PU49015-2	Rack Gear (L)		1
4	LPSP2006Z	Screw		4
5	PU32446A	Slide Plate Ass'y		1
6	REE3000	"E" Ring		3
7	PU35005-17	Spring		2
8	PU32543A	Guide Stay (R) Ass'y		1
9	PU49000	Shaft		1
10	PU49026	Warm		1
11	REE2000	"E" Ring		2
12	Q03093-827	Washer		1
13	PU48941	Belt		1
14	PU49851A	Sprocket Ass'y		1
15	REE2500	"E" Ring		3
16	PU49031	Chain		1
⚠ 17	PU49158A	Motor Ass'y		1
18	DPSP2606Z	Screw		2
19	PU49032	Gear		1
20	PU35005-104	Spring		1
21	PU49030	Asist. Plate		1
22	PU50039	Fulcrum Screw	㊼ Cassette Housing Ass'y	1
23	PU49028	P. I. Bracket		1
24	PU49029	P. I. Board	3 7	1
25	PU48923	Photo Interrupter		1
26	LPSP3004Z	Screw		1
27	LPSP2004Z	"		1
28	PU49033	Guide Stay (L)		1
29	–	–		1
30	–	–		1
31	–	–		1
32	–	–		1
33	–	–		1
34	–	–		1
35	PU32453A	Connect Gear Ass'y		1
36	PU35005-120	Spring		2
37	" -124	"		1
38	DPSP3006Z	Screw		2
39	PU49042	Roller Ass'y		1
40	PU49046	Roller Bearing		2
41	QCF11HP-473	C Cap		1
42	PU49656	Lid Opener		1
43	T30300-101	Spring		1
44	–	–		–
45	Q03093-834	Washer		2
46	PU49485-1	Wire Clamp		1
47	PUS25912A	Cassette Housing Ass'y		1

SECTION 8
CHARTS AND DIAGRAMS

8.1 ELECTRICAL PARTS LOCATION



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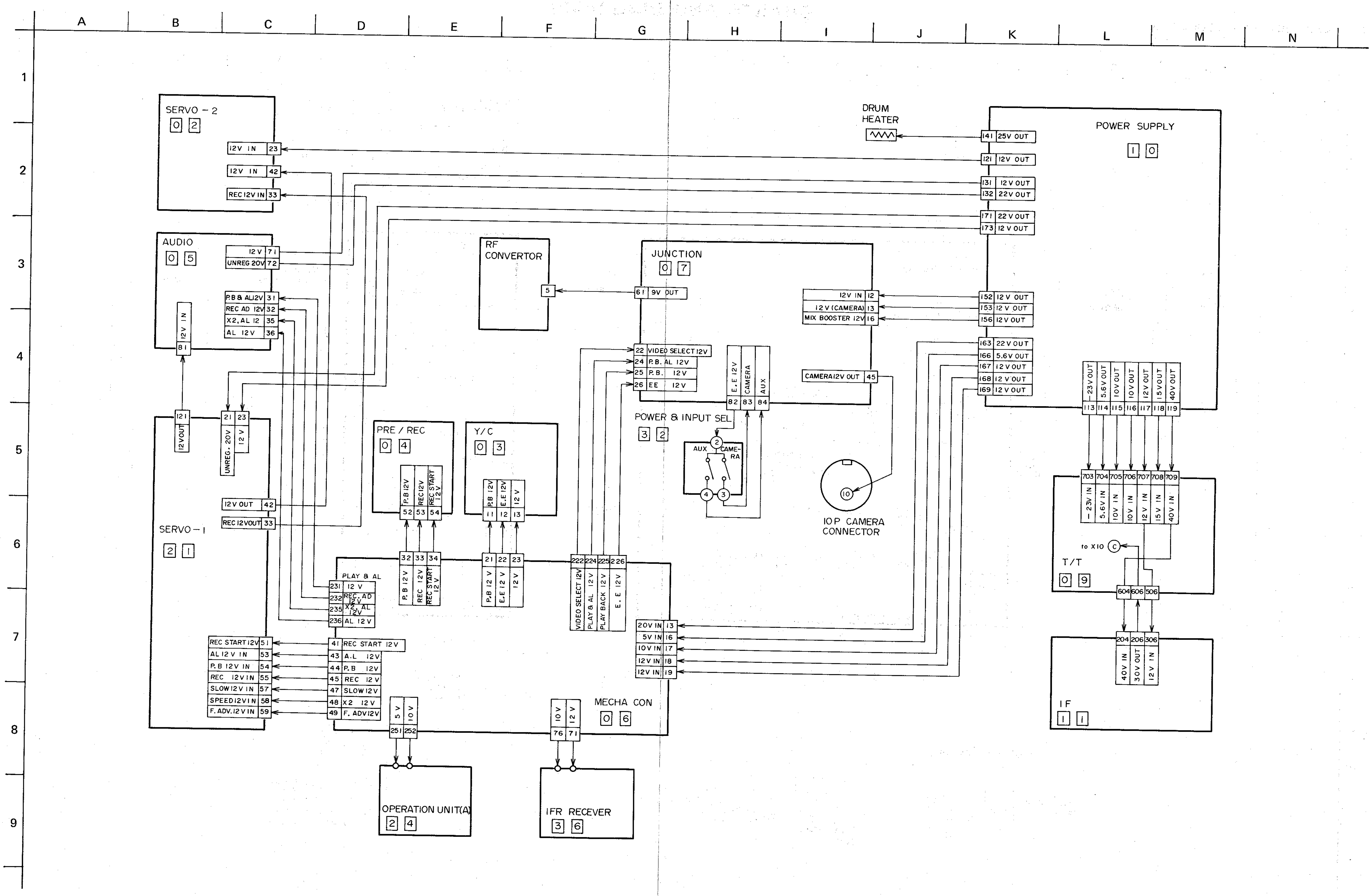
05 AUDIO
VOLTAGE SLECTOR
ANTENNA
POWER SWITCH
FUSE HOLDER
RF OUT
AC IN
VIDEO IN
MODE SWITCH
VIDEO OUT
AUDIO
REMOTE
01 SERVO-1
02 SERVO-2
END SENSOR
POWER TR X8
03 Y/COLOUR
06 MECHACON
04 PRE/REC
PINCH ROLLER SOLENO-ID
LOADING MOTOR
18 DRUM CONNECTOR
DRUM MOTOR
16 TERMINAL
CAPSTAN MOTOR
19 F.E. HEAD
A.E HEAD
16 AUDIO HEAD
R/P & CTL HEAD
AL.SW
UL.SW
CASSETTE LAMP
CUE HEAD
15 CUE HEAD
S.REEL SENSOR
REEL MOTOR
T.U.REEL SENSOR
F.G CASSETTE SENSOR
20
CASSETTE SWITCH
MAIN SOLEN-OID
REC SAFETY SENSOR
CASSETTE MOTOR
07 JUNCTION
START SENSOR
MIX BOOSTER
POWER TR X3
RF CONVERTER
NOISE FILTER
POWER TRANS
POWER TR X1
POWER DIODE
45 TUNER
11 I.F.
TUNER
08 DISPLAY CONTROL
46 BACK UP
31 DISPLAY HOLDER
09 T/T CONTROL
10 POWER SUPPLY
DISPLAY
REMOTE SENSOR
36 IFR RECEIVER
24 KEY SEARCH(A)
35 KEY SEARCH(B)
33 SWITCH
HEADPHONS JACK
MIC JACK
TAPE MEMORY SWITCH
SLOW/STILL TRACKING VR
X2/PLAY TRACKING VR
CAMERA CONN (10PIN)
CH LOCK SWITCH
DIMMER SWITCH

8.2 DC POWER SUPPLY LINE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12V IN 23
12V IN 42
REC 12V IN 33
AUDIO
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12V 71
UNREG 20V 72
P.B & AL 12V 31
REC AD 12V 32
X2, AL 12 35
AL 12V 36
12V IN 81
RF CONVERTOR
5
JUNCTION
0 7
61 9V OUT
12V IN 12
12V (CAMERA) 13
MIX BOOSTER 12V 16
22 VIDEO SELECT 12V
24 P.B. AL 12V
25 P.B. 12V
26 EE 12V
E.E 12V
CAMERA
AUX
82 83 84
CAMERA 12V OUT 45
POWER & INPUT SEL
3 2
AUX
CAMERA
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10P CAMERA CONNECTOR
DRUM HEATER
POWER SUPPLY
1 0
141 25V OUT
121 12V OUT
131 12V OUT
132 22V OUT
171 22V OUT
173 12V OUT
152 12V OUT
153 12V OUT
156 12V OUT
163 22V OUT
166 5.6V OUT
167 12V OUT
168 12V OUT
169 12V OUT
–23V OUT
5.6V OUT
10V OUT
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15V OUT
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113 114 115 116 117 118 119
703 704 705 706 707 708 709
–23V IN
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10V IN
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SERVO – 1
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12V OUT
21 23
UNREG. 20V
12V
12V OUT 42
REC 12V OUT 33
REC START 12V 51
AL 12V IN 53
P.B 12V IN 54
REC 12V IN 55
SLOW 12V IN 57
SPEED 12V IN 58
F.ADV. 12V IN 59
PRE / REC
0 4
P.B 12V
REC 12V
REC START 12V
52 53 54
Y/C
0 3
P.B 12V
E.E 12V
12V
11 12 13
PLAY & AL
231 12V
232 REC AD 12V
235 X2 AL 12V
236 AL 12V
32 33 34
P.B 12V
REC 12V
REC START 12V
21 22 23
P.B 12V
E.E 12V
12V
222 224 225 226
VIDEO SELECT 12V
PLAY & AL 12V
PLAY BACK 12V
E.E 12V
20V IN 13
5V IN 16
10V IN 17
12V IN 18
12V IN 19
41 REC START 12V
43 A.L 12V
44 P.B 12V
45 REC 12V
47 SLOW 12V
48 X2 12V
49 F. ADV 12V
5V
10V
251 252
10V
12V
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MECHA CON
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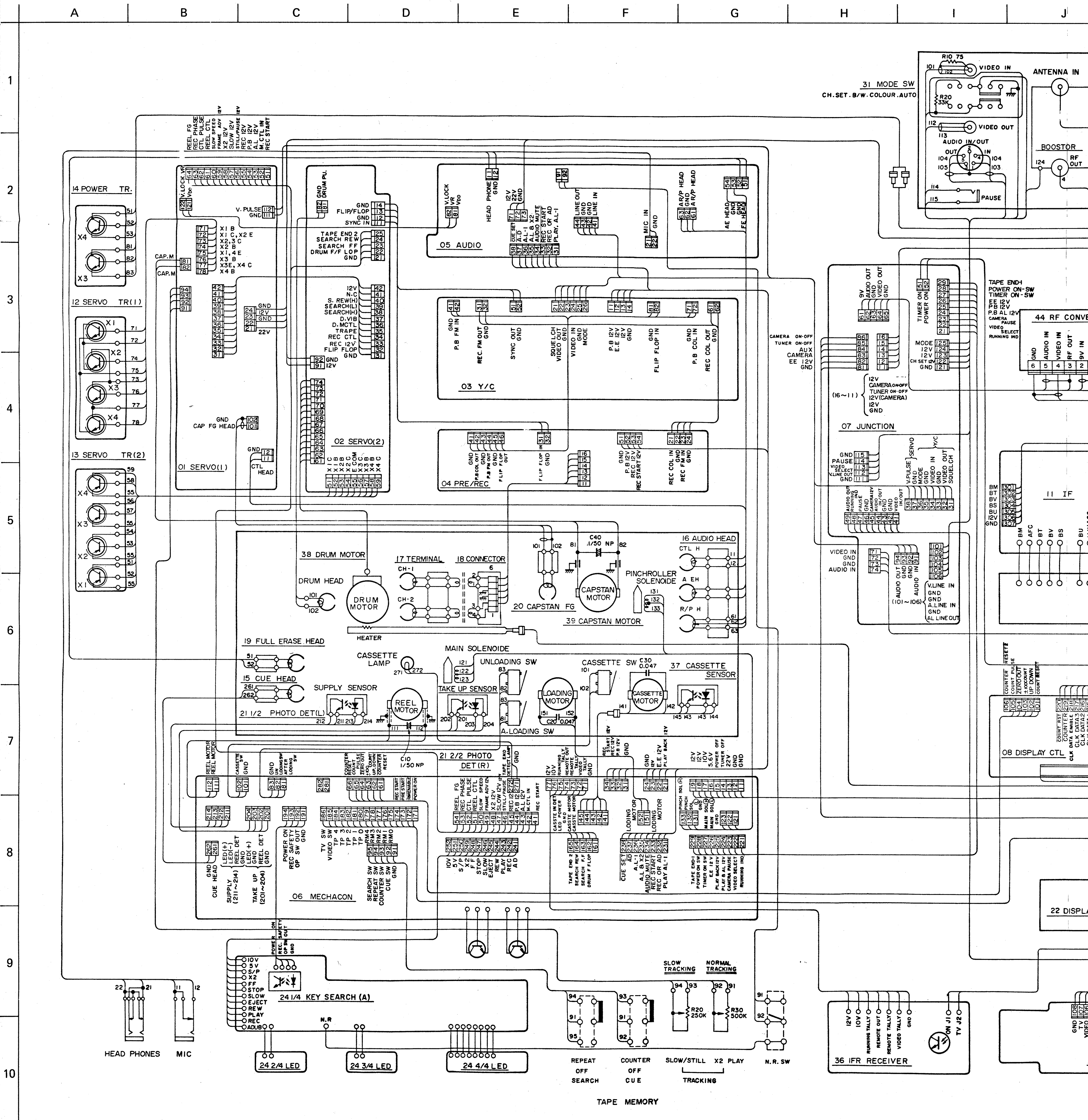
OPERATION UNIT(A)
2 4
IFR RECEVER
3 6

8.3 OVERALL WIRING


A
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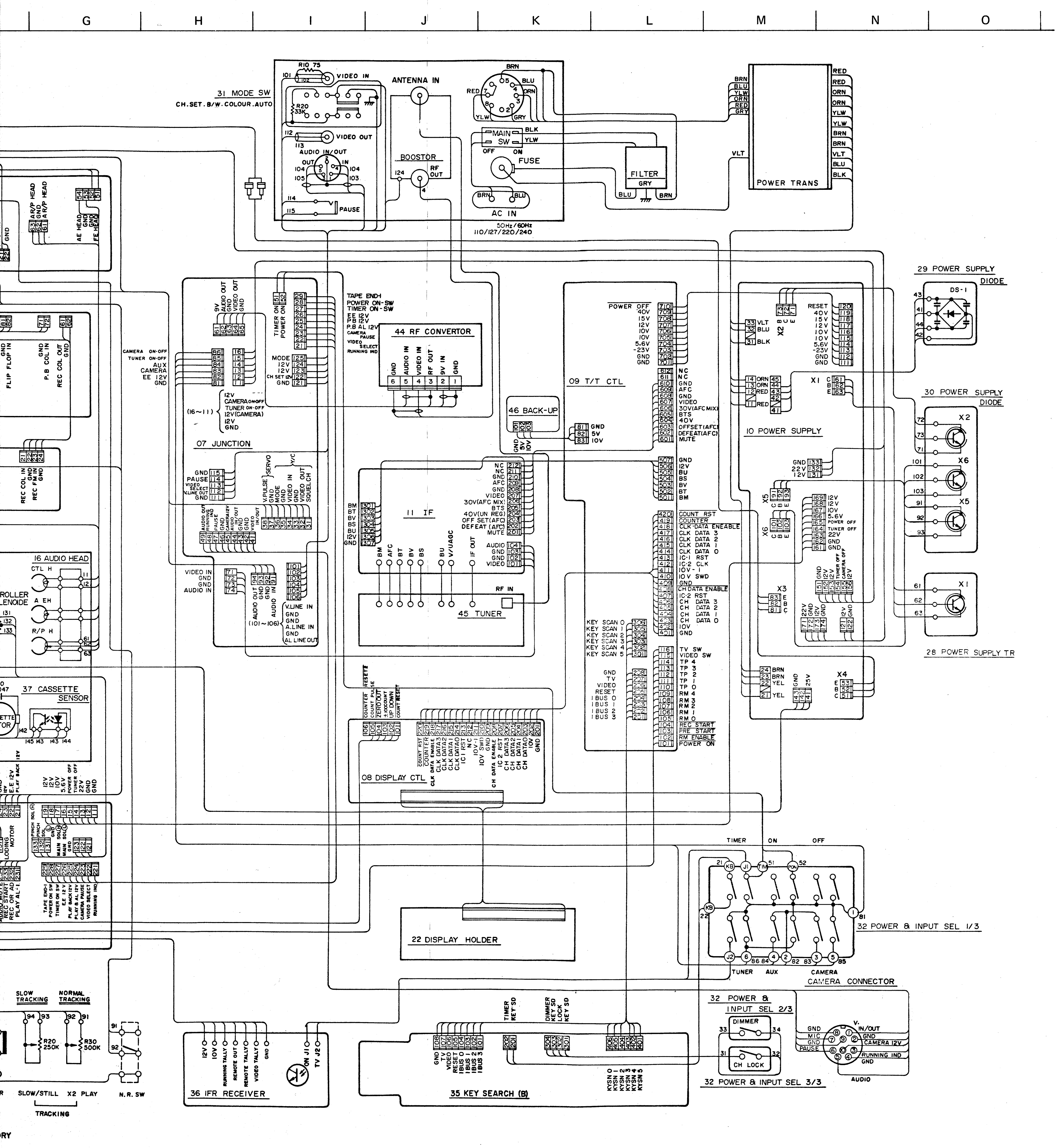
9
10
14 POWER TR.
12 SERVO TR(1)
13 SERVO TR(2)
01 SERVO(1)
02 SERVO(2)
03 Y/C
04 PRE/REC
05 AUDIO
06 MECHACON
07 JUNCTION
08 DISPLAY CTL
11 IF
15 CUE HEAD
16 AUDIO HEAD
17 TERMINAL
18 CONNECTOR
19 FULL ERASE HEAD
20 CAPSTAN FG
21 1/2 PHOTO DET(L)
21 2/2 PHOTO DET(R)
22 DISPL
24 1/4 KEY SEARCH (A)
24 2/4 LED
24 3/4 LED
24 4/4 LED
31 MODE SW
CH.SET. B/W. COLOUR. AUTO
36 IFR RECEIVER
37 CASSETTE SENSOR
38 DRUM MOTOR
39 CAPSTAN MOTOR
44 RF CONVE
BOOSTOR
ANTENNA IN
VIDEO IN
VIDEO OUT
AUDIO IN/OUT
PAUSE
RF OUT
DRUM HEAD
DRUM MOTOR
CAPSTAN MOTOR
PINCHROLLER SOLENOIDE
MAIN SOLENOIDE
CASSETTE LAMP
UNLOADING SW
CASSETTE SW
SUPPLY SENSOR
TAKE UP SENSOR
REEL MOTOR
LOADING MOTOR
CASSETTE MOTOR
A.LOADING SW
HEATER
CH-1
CH-2
CTL H
A EH
R/P H
C40 1/50 NP
C30 0.047
C20 0.047
C10 1/50 NP
HEAD PHONES
MIC
REPEAT OFF SEARCH
COUNTER OFF CUE
SLOW/STILL X2 PLAY
TRACKING
SLOW TRACKING
NORMAL TRACKING
R20 250K
R30 500K
N.R. SW
N.R
TAPE MEMORY
ON J1
TV J2
12V
10V
RUNNING TALLY
REMOTE OUT
REMOTE TALLY
VIDEO TALLY
GND
REEL FG
REC PHASE
CTL PULSE
REEL CTL
SLOW SPEED
FRAME ADV 12V
X2 12V
SLOW 12V
STILL/PAUSE 12V
REC 12V
P.B 12V
A.L 12V
M. CTL IN
REC START
V.LOCK VR
VDD
V. PULSE
CAP.M
X1 B
X1 C, X2 E
X2, 3 C
X2 B
X1, 4 E
X3 B
X3E, X4 C
X4 B
CAP FG HEAD
CTL HEAD
22V
DRUM PU.
FLIP/FLOP
SYNC IN
TAPE END 2
SEARCH REW
SEARCH FF
DRUM F/F LOP
N.C
S. REW(H)
SEARCH(L)
SEARCH(H)
D.VIB
D.MCTL
TRAPE
REC CTL
FLIP FLOP
X1 C
X1 B
X2 B
X2 C
E COM
X3 C
X3 B
X4 B
X4 C
HEAD PHONE
CUE SET
A.D
A.L-1
A.L B X2
AUDIO MUTE
REC OR AD
PLAY, A.L-1
LINE OUT
LINE IN
MIC IN
AR/P HEAD
AE HEAD
FE HEAD
P.B FM IN
REC. FM OUT
SYNC OUT
SQUELCH
VIDEO OUT
VIDEO IN
MODE
E.E 12V
FLIP FLOP IN
P.B COL IN
REC COL OUT
P.B COL OUT
P.B FM OUT
REC START 12V
REC COL IN
REC FM IN
CAMERA ON-OFF
TUNER ON-OFF
AUX
CAMERA
EE 12V
9V
AUDIO OUT
TIMER ON
POWER ON
CH SET 12V
12V (CAMERA)
(16~11)
PAUSE
VIDEO SELECT
V.LINE OUT
RUNNING IND
CAMERA 12V
AUDIO IN/OUT
VIDEO IN/OUT
SERVO
Y/C
V.PULSE
(101~106)
V.LINE IN
A.LINE IN
A.L LINE OUT
TAPE END-1
POWER ON-SW
TIMER ON-SW
P.B A.L 12V
CAMERA PAUSE
RUNNING IND
BM
AFC
BT
BV
BS
BU
COUNTER RESET
COUNT PULSE
ZERO OUT
±.XXXCOUNT
UP DOWN
COUNT RST
COUNTER
CLK DATA ENABLE
CLK DATA3
CLK DATA2
CUE HEAD
SUPPLY (211~214)
TAKE UP (201~204)
LED(+)
LED(-)
REEL DET
POWER ON
REC SAFETY
OP SW OUT
TV SW
VIDEO SW
TP 4
TP 3
TP 2
TP 1
TP 0
SEARCH SW
REPEAT SW
COUNTER SW
CUE SW
RM4
RM3
RM2
RM1
RM0
REEL MOTOR
CASSETTE SW
UN LOADING SW AFTER LODING SW
COUNTER RESET
COUNT PULSE
ZERO OUT
UP. DOWN
REC START
PRE START
RM ENABLE
10V
5V
S/P
X2
FF
STOP
SLOW
EJECT
REW
PLAY
REC
AD
TAPE END DETECT LAMP
CASSETE IN DET
LED POWER
CASSETE MOTOR
RUNNING TALLY
REMOTE OUT
REMOTE TALLY
VIDEO TALLY
LODING MOTOR
E.E 12V
PLAY BACK 12V
PINCH SOL
MAIN SOL
TIMER ON SW
CAMERA PAUSE
VIDEO SELECT
RUNNING IND
5.6V
POWER OFF
TUNER OFF
ADUB


G
H
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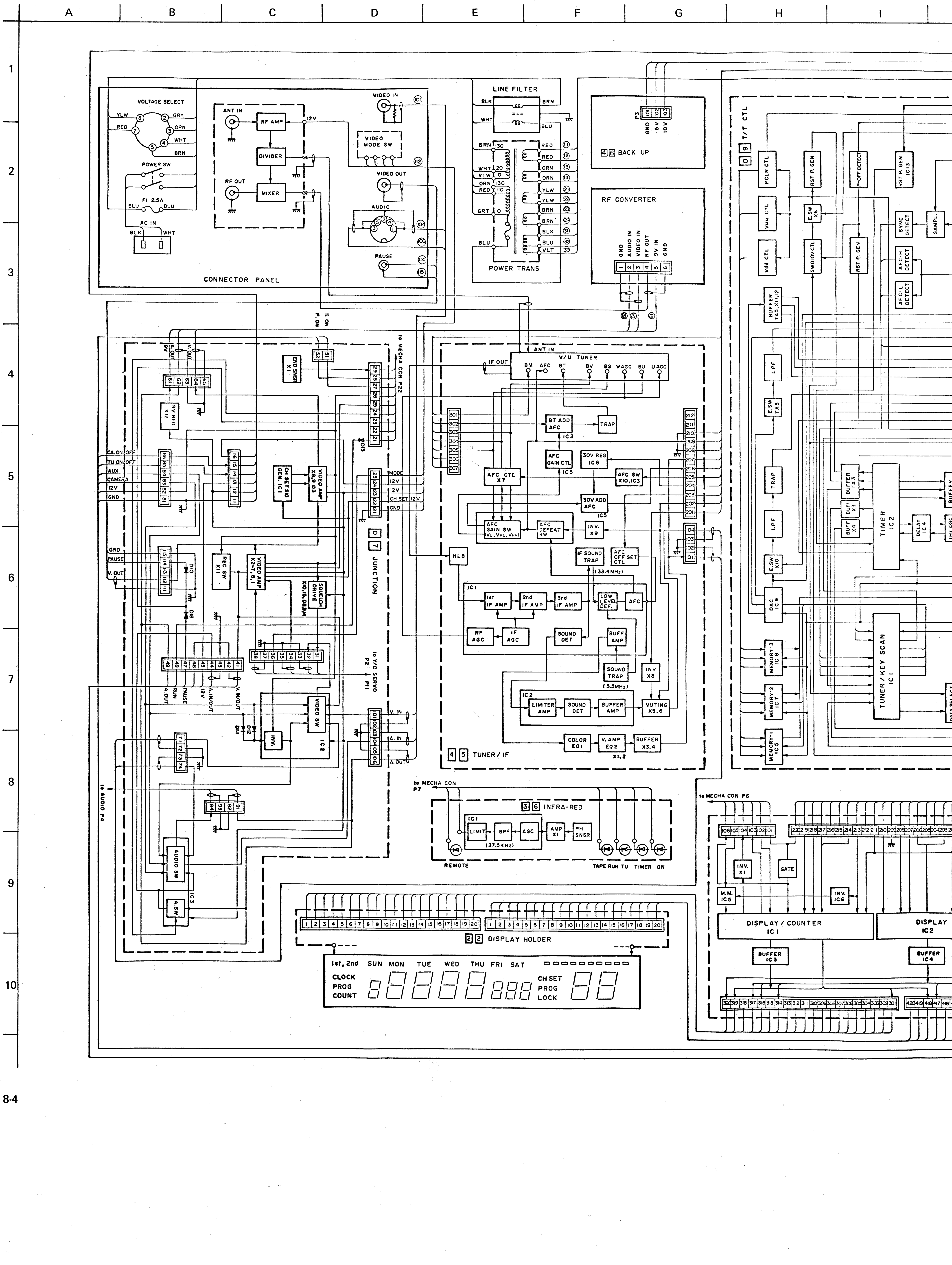
J
K
L
M
N
O
31 MODE SW
CH.SET.B/W.COLOUR.AUTO
VIDEO IN
VIDEO OUT
AUDIO IN/OUT
PAUSE
ANTENNA IN
BOOSTOR
RF OUT
MAIN SW
FUSE
FILTER
AC IN
50Hz/60Hz
110/127/220/240
POWER TRANS
29 POWER SUPPLY DIODE
DS-1
30 POWER SUPPLY DIODE
X2
X6
X5
X1
28 POWER SUPPLY TR
07 JUNCTION
44 RF CONVERTOR
46 BACK-UP
09 T/T CTL
10 POWER SUPPLY
11 IF
45 TUNER
RF IN
16 AUDIO HEAD
ROLLER SOLENOIDE
37 CASSETTE SENSOR
08 DISPLAY CTL
22 DISPLAY HOLDER
TIMER
ON
OFF
32 POWER & INPUT SEL 1/3
TUNER
AUX
CAMERA
CAMERA CONNECTOR
32 POWER & INPUT SEL 2/3
DIMMER
CH LOCK
32 POWER & INPUT SEL 3/3
AUDIO
36 IFR RECEIVER
35 KEY SEARCH (B)
SLOW TRACKING
NORMAL TRACKING
SLOW/STILL
X2 PLAY
TRACKING
N.R. SW

8.4 T/T CONTROL SYSTEM BLOCK DIAGRAM


A
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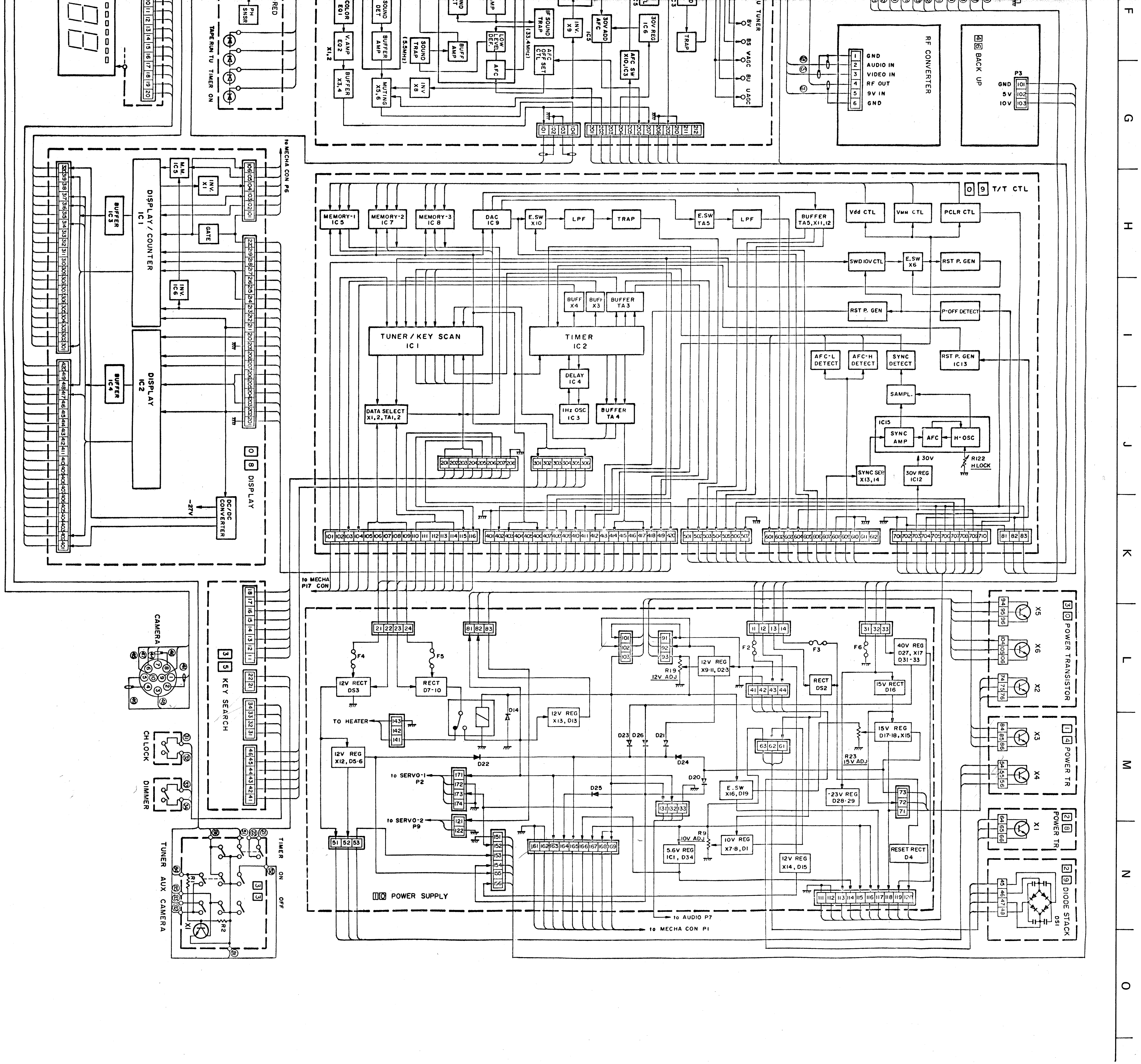
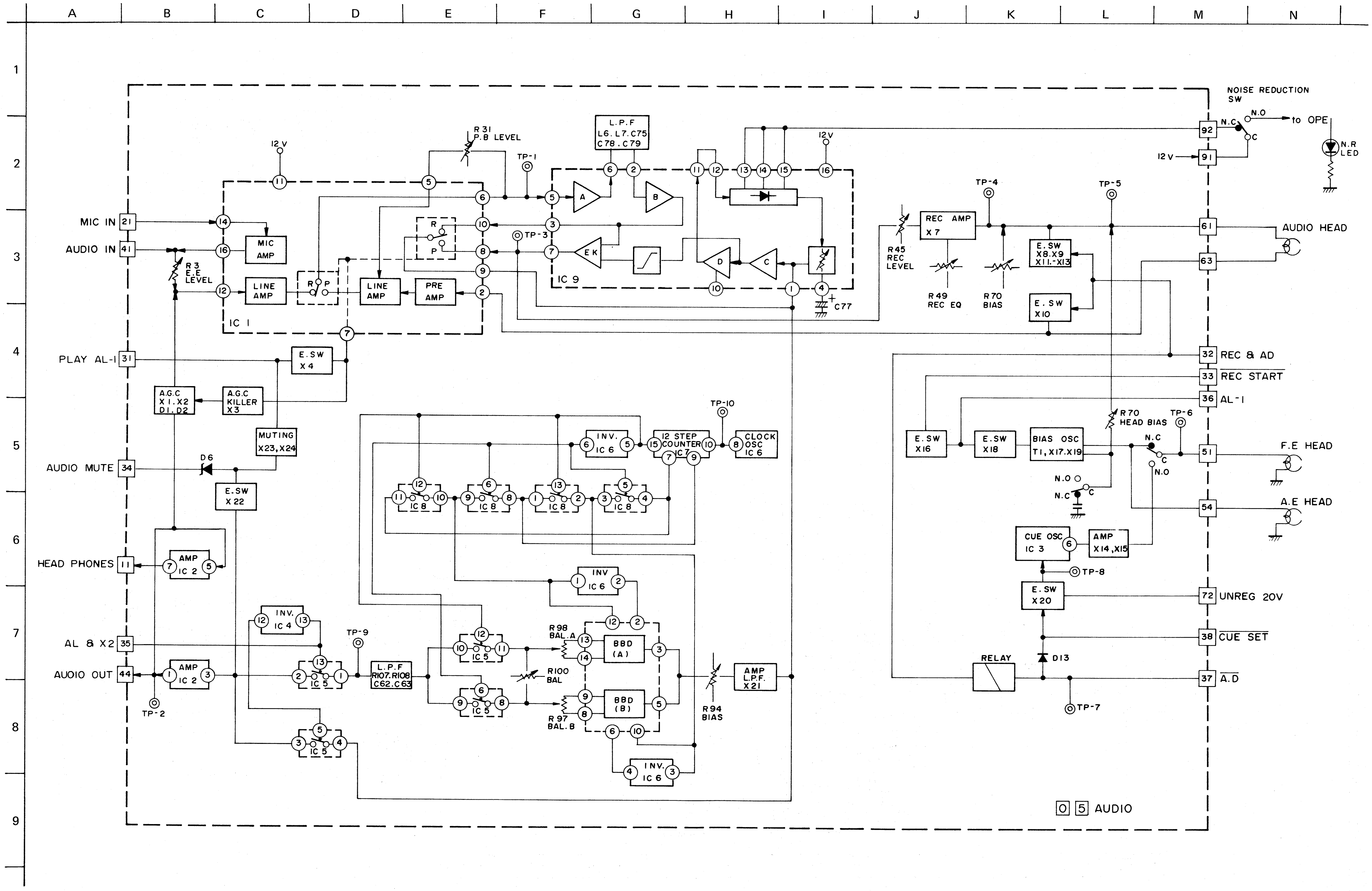
9
10
VOLTAGE SELECT
YLW
RED
GRY
ORN
WHT
BRN
POWER SW
FI 2.5A
BLU
AC IN
BLK
WHT
ANT IN
RF AMP
12V
DIVIDER
RF OUT
MIXER
VIDEO IN
VIDEO MODE SW
VIDEO OUT
AUDIO
PAUSE
CONNECTOR PANEL
LINE FILTER
POWER TRANS
4 6 BACK UP
P3
GND
5V
10V
RF CONVERTER
AUDIO IN
VIDEO IN
RF OUT
9V IN
T. ON
P. ON
to MECHA CON P22
END SNSR X1
9V REG X12
9V
A. OUT
V. OUT
CA. ON/OFF
TU ON/OFF
AUX
CAMERA
12V
GND
PAUSE
CH SET SIG GEN. IC1
VIDEO AMP X8,9 D3
MODE
CH SET 12V
D13
0 7 JUNCTION
REC SW X11
VIDEO AMP X2~7, 8, 1
SQUELCH DRIVE X10,15,D8,14
D10
D18
to Y/C SERVO P2 P11
A. OUT
RUN
PAUSE
12V
A. IN/OUT
V. IN/OUT
D11
D12
INV.
VIDEO SW
IC2
V. IN
A. IN
A. OUT
to AUDIO P4
AUDIO SW
A. SW
IC3
ANT IN
V/U TUNER
IF OUT
BM
AFC
BT
BV
BS
VAGC
BU
UAGC
BT ADD AFC
IC3
TRAP
AFC GAIN CTL
IC5
30V REG IC6
AFC CTL X7
AFC SW X10,IC3
30V ADD AFC
AFC GAIN SW (VL, VHL, VHH)
AFC DEFEAT SW
INV. X9
HLB
IF SOUND TRAP
AFC OFF SET CTL
(33.4MHz)
IC1
1st IF AMP
2nd IF AMP
3rd IF AMP
LOW LEVEL DEF.
AFC
RF AGC
IF AGC
SOUND DET
BUFF AMP
SOUND TRAP
(5.5MHz)
INV X8
IC2
LIMITER AMP
SOUND DET
BUFFER AMP
MUTING X5,6
COLOR EQ1
V. AMP EQ2
X1,2
BUFFER X3,4
4 5 TUNER/IF
to MECHA CON P7
3 6 INFRA-RED
LIMIT
BPF
AGC
(37.5KHz)
AMP X1
PH SNSR
REMOTE
TAPE RUN
TU
TIMER
ON
2 2 DISPLAY HOLDER
1st, 2nd
SUN
MON
TUE
WED
THU
FRI
SAT
CLOCK
PROG
COUNT
CH SET
PROG
LOCK
0 9 T/T CTL
PCLR CTL
RST P. GEN
P-OFF DETECT
RST P. GEN IC13
VMM CTL
E.SW X6
SYNC DETECT
SAMPL.
Vdd CTL
SWD10V CTL
RST P. GEN
AFC-H DETECT
AFC-L DETECT
BUFFER TA5,X11,12
LPF
E.SW TA5
TRAP
BUFFER TA3
BUFF X3
BUFF X4
TIMER IC2
DELAY IC4
1Hz OSC
E.SW X10
DAC IC9
TUNER/KEY SCAN IC1
MEMORY-3 IC8
MEMORY-2 IC7
MEMORY-1 IC5
DATA SELECT
to MECHA CON P6
INV. X1
GATE
M.M. IC5
INV. IC6
DISPLAY/COUNTER IC1
DISPLAY IC2
BUFFER IC3
BUFFER IC4


MEMORY-1 IC5
MEMORY-2 IC7
MEMORY-3 IC8
DAC IC9
E.SW X10
LPF
TRAP
E.SW TA5
LPF
BUFFER TA5, X11, 12
Vdd CTL
VMM CTL
PCLR CTL
0 9 T/T CTL
SWD 10V CTL
E.SW X6
RST P. GEN
BUFF X4
BUFF X3
BUFFER TA3
RST P. GEN
P-OFF DETECT
TUNER / KEY SCAN IC1
TIMER IC2
AFC-L DETECT
AFC-H DETECT
SYNC DETECT
RST P. GEN IC13
DELAY IC4
SAMPL.
DATA SELECT X1, 2, TA1, 2
1Hz OSC IC3
BUFFER TA4
IC15
SYNC AMP
AFC
H-OSC
30V
R122 H LOCK
SYNC SEP. X13, 14
30V REG IC12
DISPLAY / COUNTER IC1
BUFFER IC3
DISPLAY IC2
BUFFER IC4
M.M. IC5
INV. X1
GATE
INV. IC6
DC/DC CONVERTER
-27V
0 8 DISPLAY
to MECHA CON P6
to MECHA P17 CON
RF CONVERTER
GND
AUDIO IN
VIDEO IN
RF OUT
9V IN
GND
4 6 BACK UP
P3
GND
5V
10V
COLOR EQ1
V.AMP EQ2 X1,2
BUFFER X3,4
SOUND DET
BUFFER AMP
SOUND TRAP (5.5MHz)
BUFF AMP
MUTING X5,6
INV X8
LOW PASS DET
IF SOUND TRAP (33.4MHz)
AFC
AFC SET CTL
INV X9
30V ADD AFC IC5
AFC SW X10, IC3
30V REG IC6
TRAP
U TUNER
BV
BS
VAGC
BU
UAGC
RED
PH SNSR
TAPE RUN TU TIMER ON
CAMERA
CH LOCK
DIMMER
3 5 KEY SEARCH
TUNER AUX CAMERA
TIMER ON OFF
3 3
R1
R2
X1
F4
F5
12V RECT DS3
RECT D7-10
TO HEATER
D14
12V REG X13, D13
12V REG X12, D5-6
D22
to SERVO-1 P2
to SERVO-2 P9
D23 D26 D21
D24
D20
D25
F2
F3
F6
R19 12V ADJ
12V REG X9-11, D23
RECT DS2
40V REG D27, X17 D31-33
15V RECT D16
15V REG D17-18, X15
R23 15V ADJ
E.SW X16, D19
-23V REG D28-29
R9 10V ADJ
5.6V REG IC1, D34
10V REG X7-8, D1
12V REG X14, D15
RESET RECT D4
1 0 POWER SUPPLY
to AUDIO P7
to MECHA CON P1
X5
X6
X2
3 0 POWER TRANSISTOR
X3
X4
1 4 POWER TR
X1
2 8 POWER TR
2 9 DIODE STACK
DS1
F
G
H
I
J
K
L
M
N
O

8.5 AUDIO SYSTEM BLOCK DIAGRAM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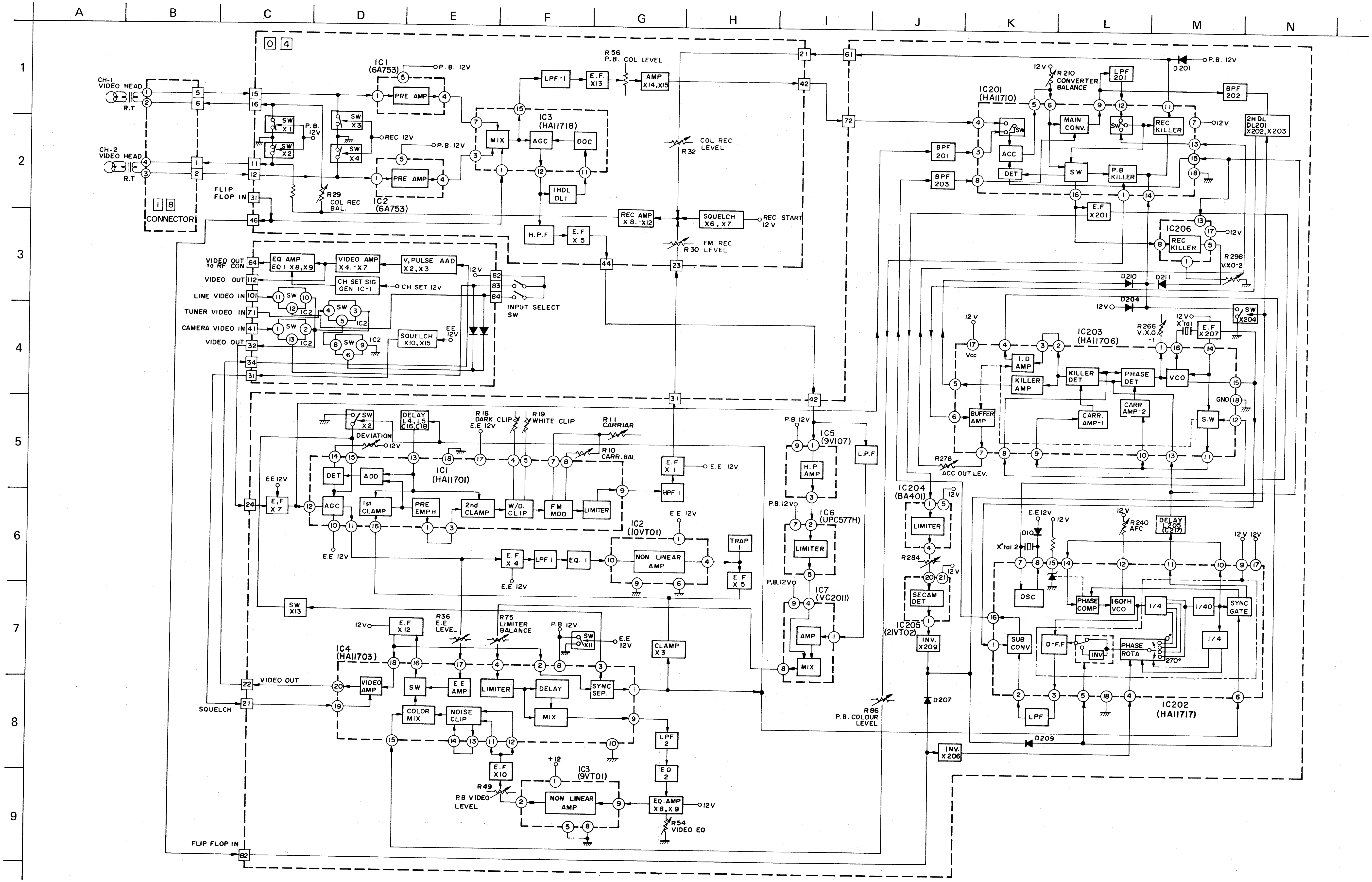
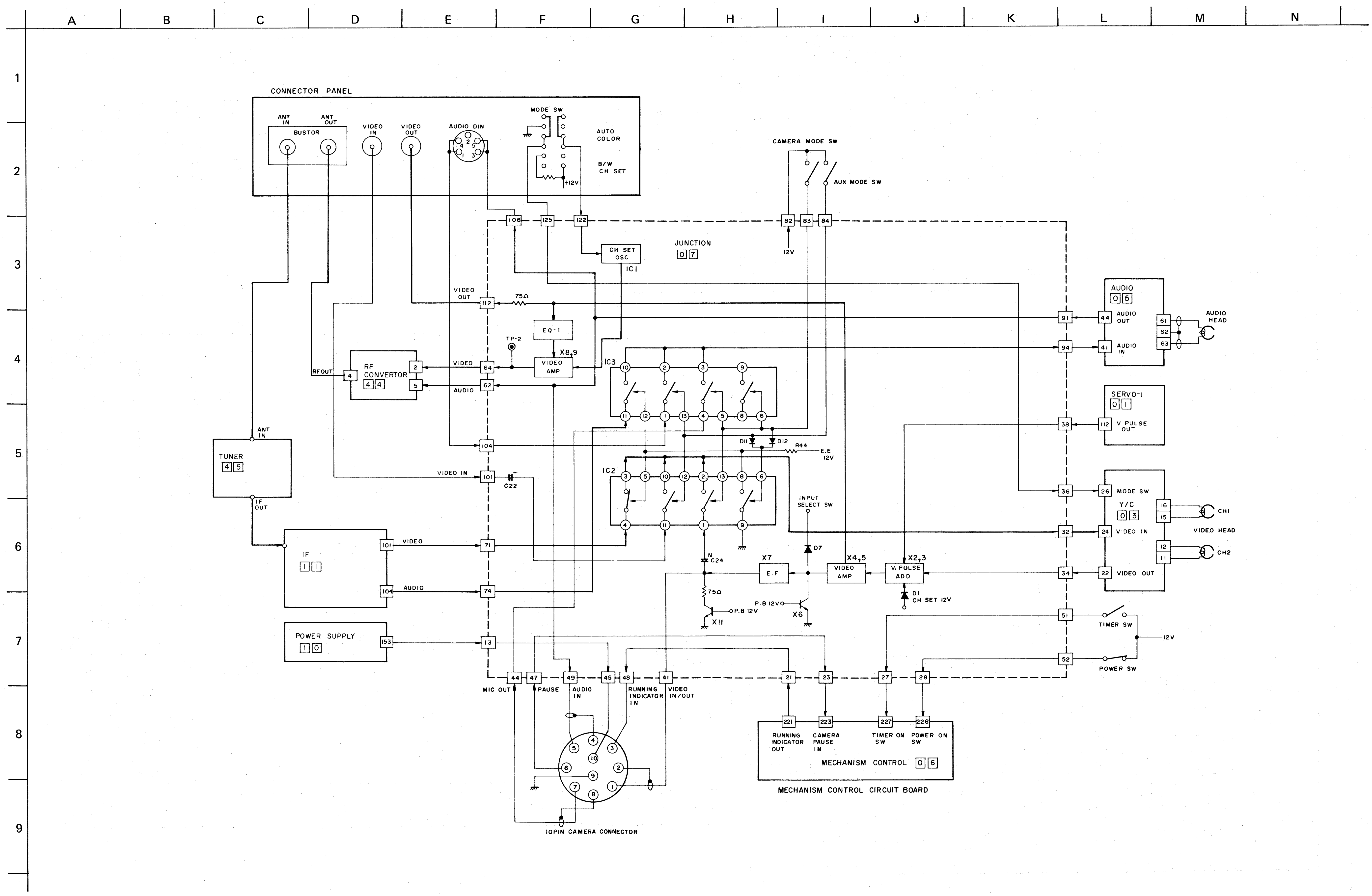
G
H
I
J
K
L
M
N
1
2
3
4
5
6
7
8
9
NOISE REDUCTION SW
N.C
N.O
C
to OPE
N.R LED
92
91
12V
L.P.F L6. L7. C75 C78. C79
R31 P.B LEVEL
TP-1
12V
12V
MIC IN
21
AUDIO IN
41
MIC AMP
LINE AMP
LINE AMP
PRE AMP
R3 E.E LEVEL
R
P
IC 1
TP-3
A
B
EK
C
D
IC 9
C77
TP-4
TP-5
R45 REC LEVEL
REC AMP X7
R49 REC EQ
R70 BIAS
E.SW X8.X9 X11.-X13
E.SW X10
61
63
AUDIO HEAD
PLAY AL-1
31
E.SW X4
A.G.C X1.X2 D1.D2
A.G.C KILLER X3
MUTING X23,X24
AUDIO MUTE
34
D6
E.SW X22
REC & AD
32
REC START
33
AL-1
36
TP-10
INV. IC 6
12 STEP COUNTER IC 7
CLOCK OSC IC 6
IC 8
E.SW X16
E.SW X18
BIAS OSC T1, X17.X19
R70 HEAD BIAS
TP-6
N.C
C
N.O
F.E HEAD
51
A.E HEAD
54
HEAD PHONES
11
AMP IC 2
INV IC 6
CUE OSC IC 3
AMP X14, X15
TP-8
E.SW X20
UNREG 20V
72
AL & X2
35
INV. IC 4
TP-9
R98 BAL.A
BBD (A)
R100 BAL
BBD (B)
R97 BAL.B
R94 BIAS
AMP L.P.F. X21
CUE SET
38
RELAY
D13
AUDIO OUT
44
AMP IC 2
L.P.F R107. R108 C62. C63
IC 5
TP-2
INV. IC 6
A.D
37
TP-7
0 5 AUDIO

8.6 VIDEO SYSTEM BLOCK DIAGRAM


A B C D E F G H I J K L M N
1 2 3 4 5 6 7 8 9
04
18
CONNECTOR
CH-1 VIDEO HEAD
CH-2 VIDEO HEAD
R.T
FLIP FLOP IN
IC1 (6A753)
IC2 (6A753)
PRE AMP
P.B. 12V
REC 12V
SW X1
SW X2
SW X3
SW X4
R29 COL REC BAL.
IC3 (HA11718)
MIX
AGC
DOC
1HDL DL1
H.P.F
E.F X5
LPF-1
E.F. X13
R56 P.B. COL LEVEL
AMP X14,X15
COL REC LEVEL R32
REC AMP X8,-X12
SQUELCH X6,X7
REC START 12V
R30 FM REC LEVEL
VIDEO OUT to RF CON
VIDEO OUT
LINE VIDEO IN
TUNER VIDEO IN
CAMERA VIDEO IN
EQ AMP EQ1 X8,X9
VIDEO AMP X4.-X7
V,PULSE AAD X2,X3
CH SET SIG GEN IC-1
CH SET 12V
SQUELCH X10,X15
EE 12V
INPUT SELECT SW
IC1 (HA11701)
DELAY L4,L5 C16,C18
DEVIATION
R18 DARK CLIP E.E 12V
R19 WHITE CLIP
R11 CARRIAR
R10 CARR.BAL
DET
ADD
AGC
1st CLAMP
PRE EMPH
2nd CLAMP
W/D. CLIP
FM MOD
LIMITER
E.F X1
HPF 1
E.E 12V
E.F X7
IC2 (10VT01)
E.F. X4
LPF 1
EQ. 1
NON LINEAR AMP
TRAP
E.F. X5
SW X13
IC4 (HA11703)
E.F X12
R36 E.E LEVEL
R75 LIMITER BALANCE
SW X11
CLAMP X3
VIDEO AMP
SW
E E AMP
LIMITER
DELAY
SYNC SEP.
MIX
COLOR MIX
NOISE CLIP
SQUELCH
E.F X10
R49 P.B VIDEO LEVEL
IC3 (9VT01)
+12
LPF 2
EQ 2
EQ.AMP X8,X9
R54 VIDEO EQ
IC5 (9V107)
H.P AMP
IC6 (UPC577H)
IC7 (VC2011)
AMP
L.P.F
IC201 (HA11710)
R 210 CONVERTER BALANCE
LPF 201
BPF 202
2H DL DL201 X202,X203
MAIN CONV.
REC KILLER
ACC
P.B KILLER
BPF 201
BPF 203
E.F X201
IC206
R298 V.X0-2
D201 D210 D211 D204
IC203 (HA11706)
R266 V.X.O -1
X'tal
E.F X207
SW X204
I.D AMP
KILLER DET
KILLER AMP
PHASE DET
VCO
BUFFER AMP
CARR. AMP-1
CARR AMP-2
S.W
GND
Vcc
R278 ACC OUT LEV.
IC204 (BA401)
SECAM DET
R284
IC205 (21VT02)
INV. X209
D207
R86 P.B. COLOUR LEVEL
INV. X206
D209
D10
X'tal 2
R240 AFC
DELAY L205 C217
OSC
PHASE COMP
160fH VCO
1/4
1/40
SYNC GATE
SUB CONV
D-F.F
INV
PHASE ROTA
270°
LPF
IC202 (HA11717)

8.7 SIGNAL LINE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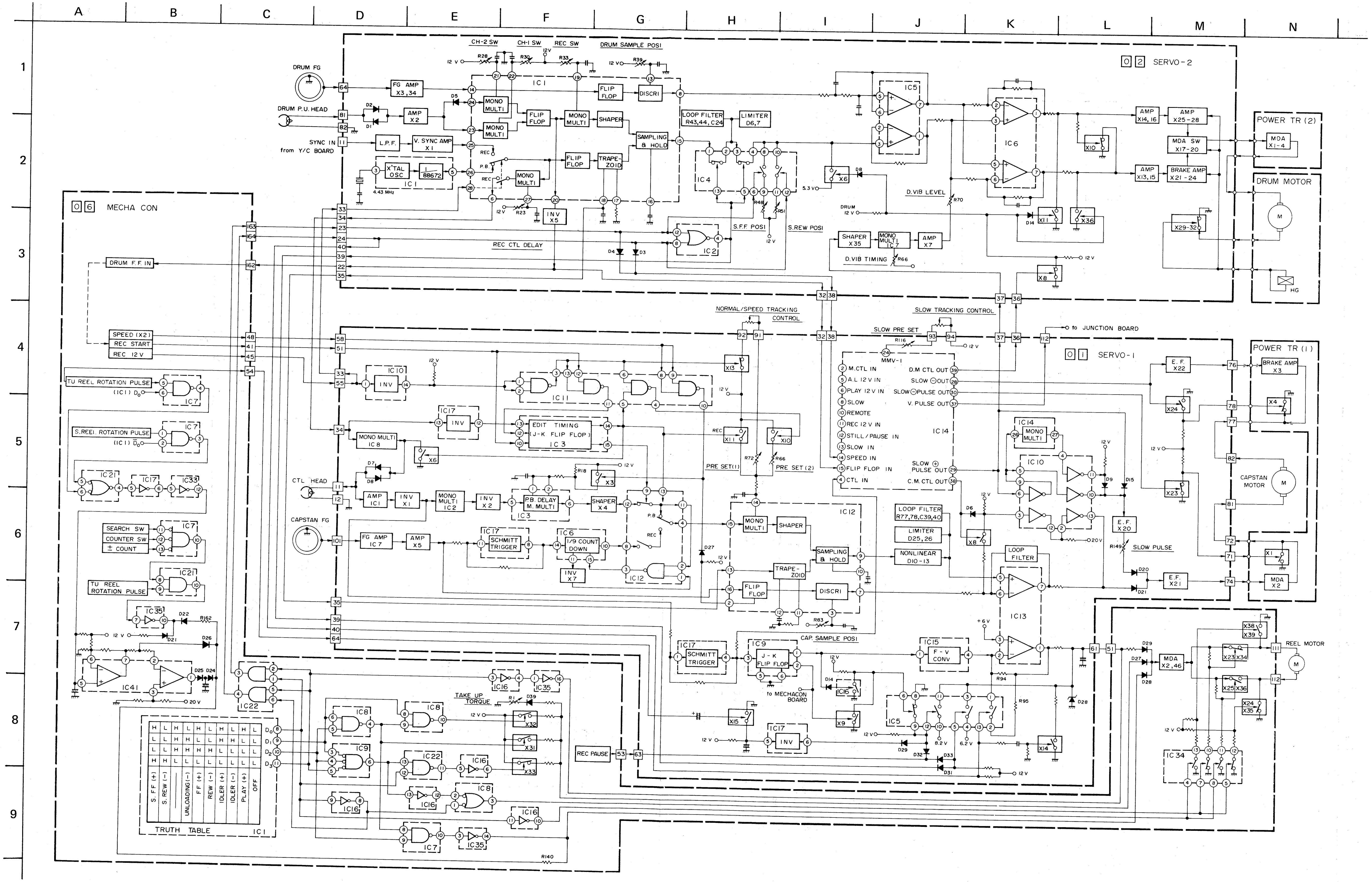
CONNECTOR PANEL
ANT IN
ANT OUT
BUSTOR
VIDEO IN
VIDEO OUT
AUDIO DIN
MODE SW
AUTO COLOR
B/W CH SET
+12V
CAMERA MODE SW
AUX MODE SW
106
125
122
82
83
84
12V
CH SET OSC
IC1
JUNCTION
07
VIDEO OUT
112
75Ω
EQ-1
TP-2
X8,9
VIDEO AMP
IC3
RF CONVERTOR
44
RFOUT
4
2
5
VIDEO
64
AUDIO
62
TUNER
45
ANT IN
IF OUT
104
VIDEO IN
101
C22
IC2
D11
D12
R44
E.E 12V
INPUT SELECT SW
D7
C24
75Ω
X7
E.F
X4,5
VIDEO AMP
X2,3
V. PULSE ADD
D1
CH SET 12V
P.B 12V
X6
X11
IF
11
101
104
VIDEO
AUDIO
71
74
POWER SUPPLY
10
153
13
44
47
49
45
48
41
21
23
27
28
MIC OUT
PAUSE
AUDIO IN
RUNNING INDICATOR IN
VIDEO IN/OUT
10PIN CAMERA CONNECTOR
221
223
227
228
RUNNING INDICATOR OUT
CAMERA PAUSE IN
TIMER ON SW
POWER ON SW
MECHANISM CONTROL
06
MECHANISM CONTROL CIRCUIT BOARD
AUDIO
05
91
94
44
AUDIO OUT
41
AUDIO IN
61
62
63
AUDIO HEAD
SERVO-1
01
38
112
V PULSE OUT
36
26
MODE SW
Y/C
03
32
24
VIDEO IN
34
22
VIDEO OUT
16
15
CH1
12
11
CH2
VIDEO HEAD
51
52
TIMER SW
POWER SW
12V

8.8 SERVO SYSTEM BLOCK DIAGRAM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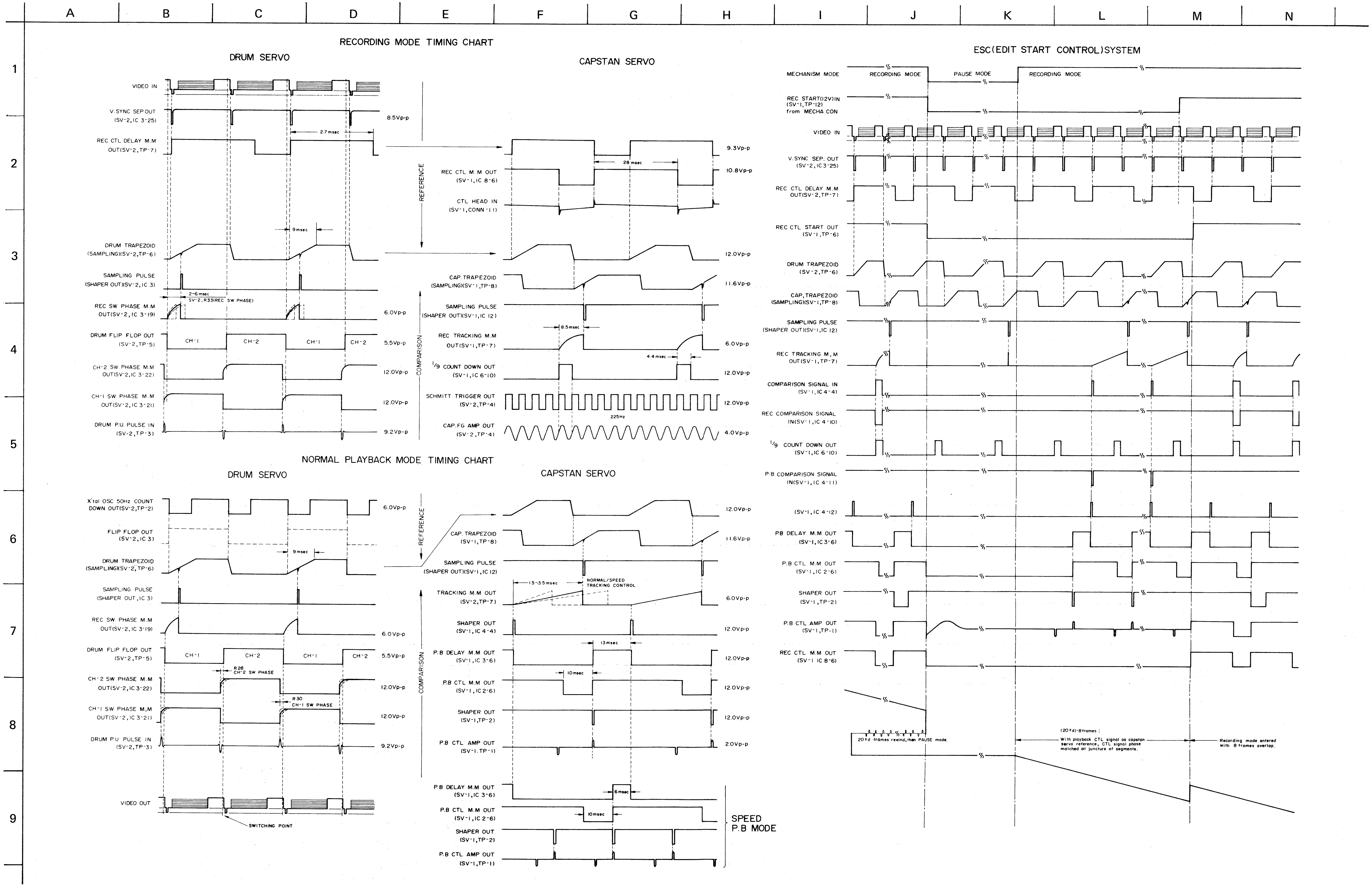
L
M
N
1
2
3
4
5
6
7
8
9
02 SERVO-2
01 SERVO-1
06 MECHA CON
POWER TR (2)
POWER TR (1)
DRUM MOTOR
CAPSTAN MOTOR
REEL MOTOR
HG
DRUM FG
DRUM P.U. HEAD
SYNC IN from Y/C BOARD
CH-2 SW
CH-1 SW
REC SW
DRUM SAMPLE POSI
FG AMP X3,34
AMP X2
L.P.F.
V. SYNC AMP X1
X'TAL OSC
1/88672
4.43 MHz
IC1
MONO MULTI
FLIP FLOP
SHAPER
TRAPE-ZOID
DISCRI
SAMPLING & HOLD
INV X5
LOOP FILTER R43,44, C24
LIMITER D6,7
IC4
IC2
IC5
IC6
S.FF POSI
S.REW POSI
REC CTL DELAY
D.VIB LEVEL
D.VIB TIMING
SHAPER X35
MONO MULTI IC7
AMP X7
AMP X14,16
AMP X25-28
MDA SW X17-20
AMP X13,15
BRAKE AMP X21-24
MDA X1-4
X29-32
X10
X11
X36
X6
X8
DRUM FF IN
SPEED (X2)
REC START
REC 12V
TU REEL ROTATION PULSE
(IC1) D0
S.REEL ROTATION PULSE
(IC1) D0
IC7
IC21
IC17
IC33
SEARCH SW
COUNTER SW
± COUNT
TU REEL ROTATION PULSE
IC35
IC41
IC22
IC8
IC9
IC16
TAKE UP TORQUE
X31
X32
X33
REC PAUSE
NORMAL/SPEED TRACKING CONTROL
SLOW TRACKING CONTROL
SLOW PRE SET
to JUNCTION BOARD
MMV-1
M.CTL IN
A.L 12V IN
PLAY 12V IN
SLOW
REMOTE
REC 12V IN
STILL/PAUSE IN
SLOW IN
SPEED IN
FLIP FLOP IN
CTL IN
D.M CTL OUT
SLOW ⊖ OUT
SLOW ⊖ PULSE OUT
V. PULSE OUT
SLOW ⊕ PULSE OUT
C.M CTL OUT
IC14
IC10 INV
IC11
IC17 INV
EDIT TIMING (J-K FLIP FLOP) IC3
MONO MULTI IC8
CTL HEAD
AMP IC1
INV X1
MONO MULTI IC2
INV X2
P.B DELAY M. MULTI IC3
SHAPER X4
X3
X13
X11
X10
PRE SET (1)
PRE SET (2)
CAPSTAN FG
FG AMP IC7
AMP X5
SCHMITT TRIGGER IC17
1/9 COUNT DOWN IC6
INV X7
IC12
MONO MULTI
SHAPER
SAMPLING & HOLD
TRAPE-ZOID
FLIP FLOP
DISCRI
LOOP FILTER R77,78,C39,40
LIMITER D25,26
NONLINEAR D10-13
LOOP FILTER
IC13
IC10
IC14 MONO MULTI
E.F X20
E.F X21
E.F X22
SLOW PULSE
BRAKE AMP X3
X4
X23
X24
X1
MDA X2
CAP. SAMPLE POSI
SCHMITT TRIGGER IC17
J-K FLIP FLOP IC9
to MECHACON BOARD
IC15 F-V CONV
X15
X9
IC16
IC17 INV
IC5
X14
MDA X2,46
X38
X39
X23 X34
X25 X36
X24 X35
IC34
12V
20V
6V
8.2V
6.2V
5.3V
R140

H	L	H	L	H	L	H	L	H	L	D0
L	L	H	H	L	L	H	H	L	L	D1
L	L	H	H	H	H	L	L	L	L	D2
H	H	L	L	L	L	L	L	L	L	D3
S. FF (+)	S. REW (−)	—	UNLOADING (−)	FF (+)	REW (−)	IDLER (+)	IDLER (−)	PLAY (+)	OFF	

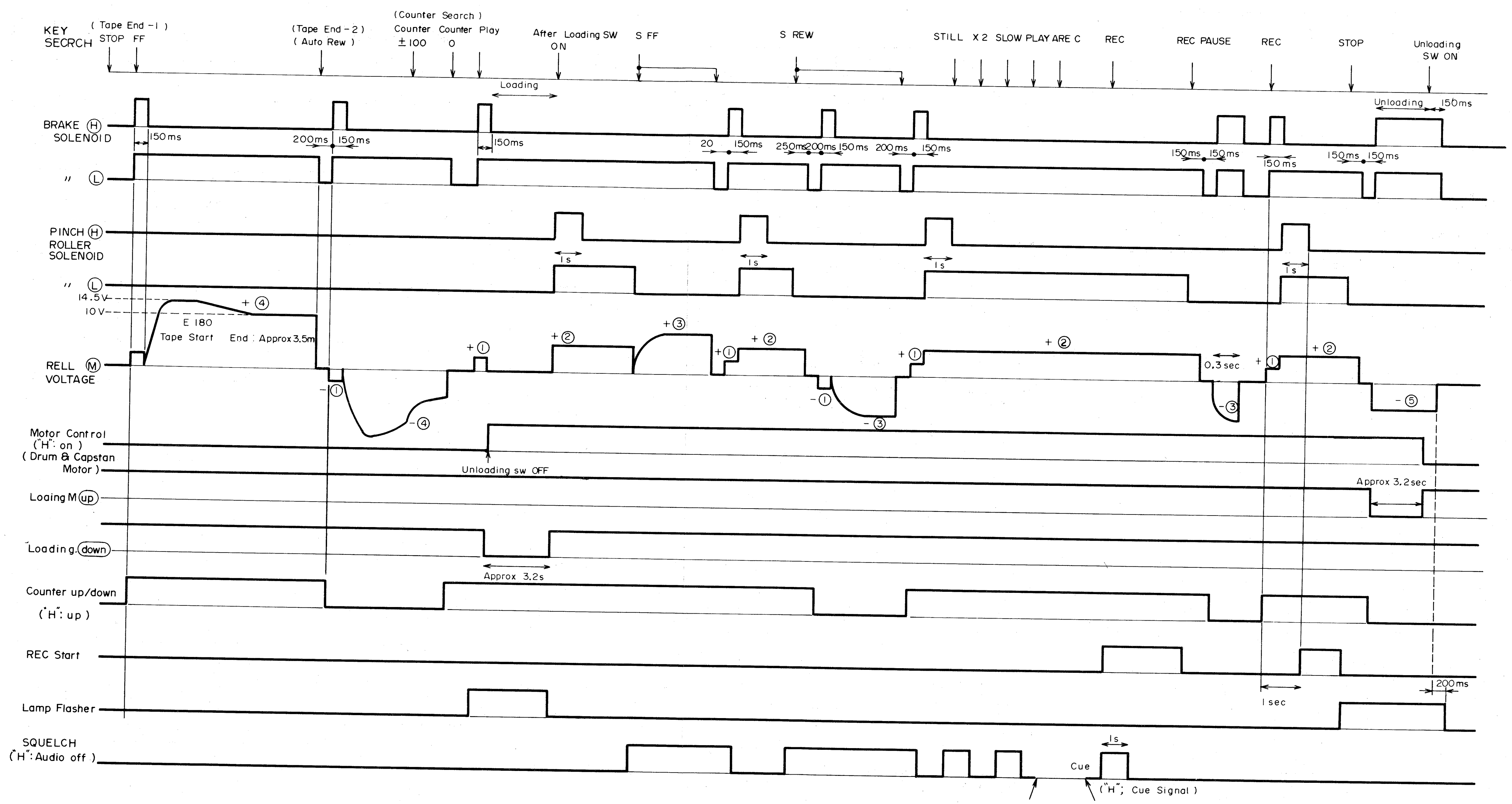
TRUTH TABLE IC1

8.9 SERVO TIMING CHART


A
B
C
D
E
F
G
H
I
J
K
L
M
N
1
2
3
4
5
6
7
8
9
RECORDING MODE TIMING CHART
DRUM SERVO
VIDEO IN
V.SYNC SEP.OUT (SV-2, IC 3-25)
8.5Vp-p
REC CTL DELAY M.M OUT(SV-2, TP-7)
2.7msec
9msec
DRUM TRAPEZOID (SAMPLING)(SV-2, TP-6)
SAMPLING PULSE (SHAPER OUT)(SV-2, IC 3)
2~6msec
SV-2, R33(REC SW PHASE)
REC SW PHASE M.M OUT(SV-2, IC 3-19)
6.0Vp-p
DRUM FLIP FLOP OUT (SV-2, TP-5)
CH-1
CH-2
CH-1
CH-2
5.5Vp-p
CH-2 SW. PHASE M.M OUT(SV-2, IC 3-22)
12.0Vp-p
CH-1 SW. PHASE M.M OUT(SV-2, IC 3-21)
12.0Vp-p
DRUM P.U. PULSE IN (SV-2, TP-3)
9.2Vp-p
REFERENCE
COMPARISON
CAPSTAN SERVO
9.3Vp-p
28 msec
REC CTL M.M OUT (SV-1, IC 8-6)
10.8Vp-p
CTL HEAD IN (SV-1, CONN-11)
12.0Vp-p
CAP.TRAPEZOID (SAMPLING)(SV-1, TP-8)
11.6Vp-p
SAMPLING PULSE (SHAPER OUT)(SV-1, IC 12)
8.5msec
REC TRACKING M.M OUT(SV-1, TP-7)
6.0Vp-p
4.4msec
1/9 COUNT DOWN OUT (SV-1, IC 6-10)
12.0Vp-p
SCHMITT TRIGGER OUT (SV-2, TP-4)
12.0Vp-p
225Hz
CAP.FG AMP OUT (SV-2, TP-4)
4.0Vp-p
NORMAL PLAYBACK MODE TIMING CHART
DRUM SERVO
X'tal OSC 50Hz COUNT DOWN OUT(SV-2, TP-2)
6.0Vp-p
FLIP FLOP OUT (SV-2, IC 3)
9msec
DRUM TRAPEZOID (SAMPLING)(SV-2, TP-6)
SAMPLING PULSE (SHAPER OUT, IC 3)
REC SW. PHASE M.M OUT(SV-2, IC 3-19)
6.0Vp-p
DRUM FLIP FLOP OUT (SV-2, TP-5)
CH-1
CH-2
CH-1
CH-2
5.5Vp-p
R28
CH-2 SW PHASE
CH-2 SW PHASE M.M OUT(SV-2, IC 3-22)
12.0Vp-p
R30
CH-1 SW PHASE
CH-1 SW. PHASE M.M OUT(SV-2, IC 3-21)
12.0Vp-p
DRUM P.U PULSE IN (SV-2, TP-3)
9.2Vp-p
VIDEO OUT
SWITCHING POINT
REFERENCE
COMPARISON
CAPSTAN SERVO
12.0Vp-p
CAP. TRAPEZOID (SV-1, TP-8)
11.6Vp-p
SAMPLING PULSE (SHAPER OUT)(SV-1, IC 12)
1.5~3.5msec
NORMAL/SPEED TRACKING CONTROL
TRACKING M.M OUT (SV-2, TP-7)
6.0Vp-p
SHAPER OUT (SV-1, IC 4-4)
12.0Vp-p
13msec
P.B DELAY M.M OUT (SV-1, IC 3-6)
12.0Vp-p
10msec
P.B CTL M.M OUT (SV-1, IC 2-6)
12.0Vp-p
SHAPER OUT (SV-1, TP-2)
12.0Vp-p
P.B CTL AMP OUT (SV-1. TP-1)
2.0Vp-p
P.B DELAY M.M OUT (SV-1, IC 3-6)
6msec
P.B CTL M.M OUT (SV-1, IC 2-6)
10msec
SHAPER OUT (SV-1, TP-2)
P.B CTL AMP OUT (SV-1, TP-1)
SPEED P.B MODE
ESC(EDIT START CONTROL)SYSTEM
MECHANISM MODE
RECORDING MODE
PAUSE MODE
RECORDING MODE
REC START(12V)IN (SV-1, TP-12) from MECHA CON
VIDEO IN
V.SYNC SEP. OUT (SV-2, IC 3-25)
REC CTL DELAY M.M OUT(SV-2, TP-7)
REC CTL START OUT (SV-1, TP-6)
DRUM TRAPEZOID (SV-2, TP-6)
CAP, TRAPEZOID (SAMPLING)(SV-1, TP-8)
SAMPLING PULSE (SHAPER OUT)(SV-1, IC 12)
REC TRACKING M, M OUT(SV-1, TP-7)
COMPARISON SIGNAL IN (SV-1, IC 4-4)
REC COMPARISON SIGNAL IN(SV-1, IC 4-10)
1/9 COUNT DOWN OUT (SV-1, IC 6-10)
P.B COMPARISON SIGNAL IN(SV-1, IC 4-11)
(SV-1, IC 4-12)
P.B DELAY M.M OUT (SV-1, IC 3-6)
P.B CTL M.M OUT (SV-1, IC 2-6)
SHAPER OUT (SV-1, TP-2)
P.B CTL AMP OUT (SV-1, TP-1)
REC CTL M.M OUT (SV-1 IC 8-6)
20+d frames rewind, then PAUSE mode.
(20+d)-8frames :
With playback CTL signal as capstan servo reference, CTL signal phase matched at juncture of segments.
Recording mode entered with 8 frames overlap.

8.10 MECHA CONTROL TIMING CHART

MECHA. CON. TIMING CHART

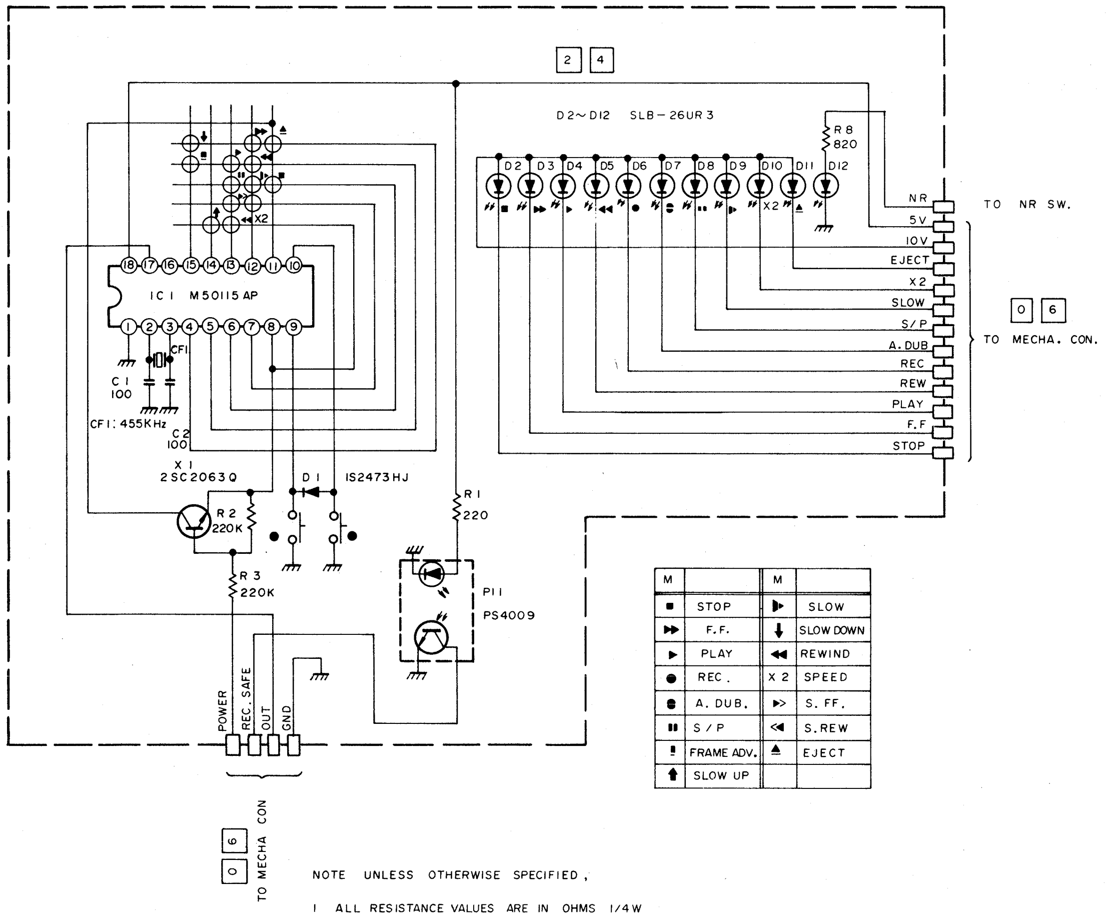


Reel Motor

Symbol No.	Name	Voltage
±①	Idler	± (P – 0.3) V
±②	Play	1.7 – 1.9 V
±③	Search	± (4 – 6) V
±④	F.F REW	± (10 –15) V
–⑤	Unloading	– (P + 0.5) V

8.11 OPERATION UNIT CIRCUIT SCHEMATIC DIAGRAM

– KEY SEARCH-(A) CIRCUIT SCHEMATIC SIAGRAM –


2 4
D2～D12 SLB－26UR3
R8 820
D2 D3 D4 D5 D6 D7 D8 D9 D10 D11 D12
X2
NR
5V
10V
EJECT
X2
SLOW
S/P
A.DUB
REC
REW
PLAY
F.F
STOP
TO NR SW.
0 6
TO MECHA. CON.
IC1 M50115AP
C1 100
CF1
CF1: 455KHz
C2 100
X1 2SC2063Q
D1 1S2473HJ
R1 220
R2 220K
R3 220K
P11 PS4009
POWER
REC. SAFE
OUT
GND
0 6
TO MECHA CON

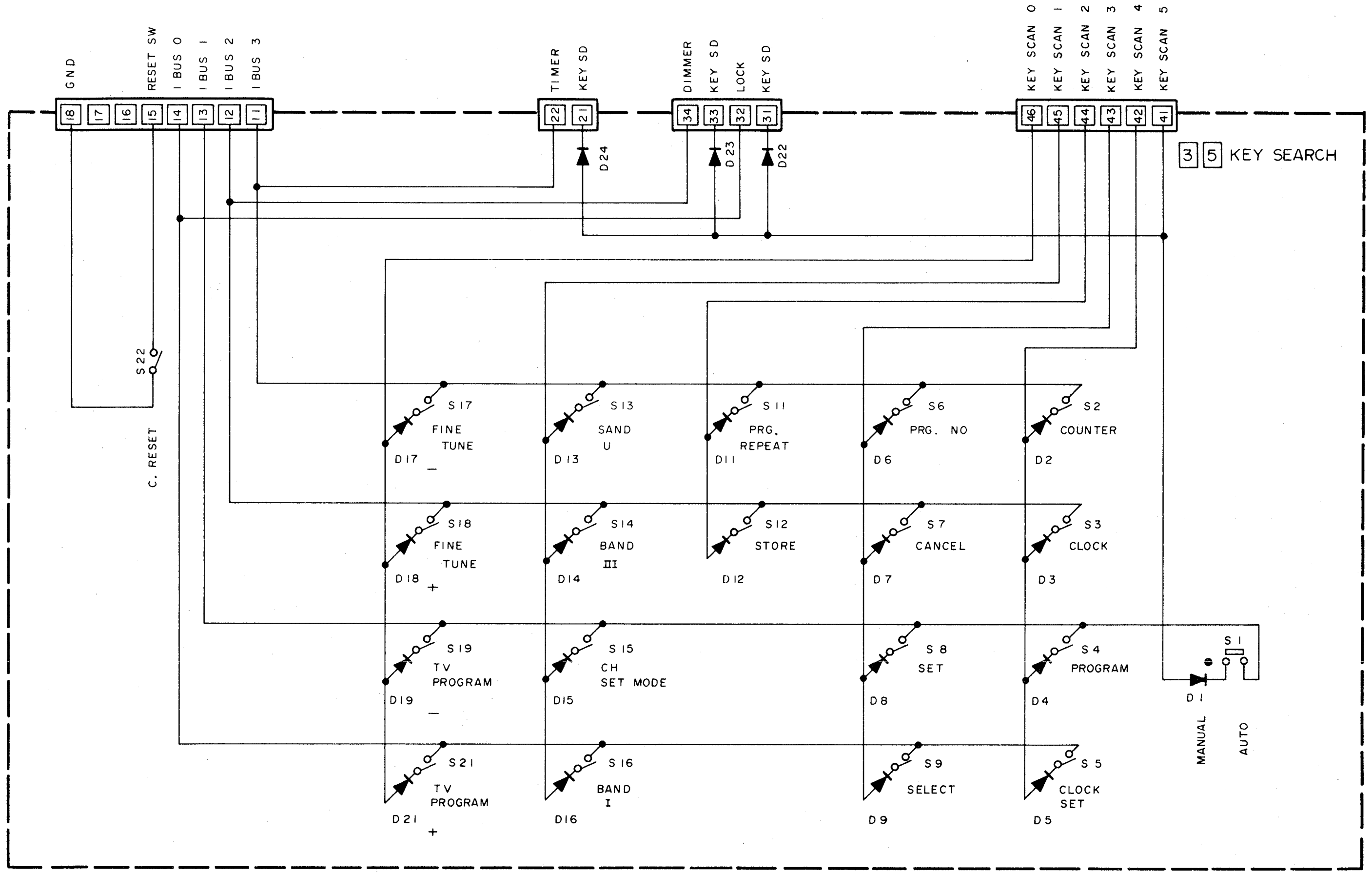
M		M	
■	STOP	▶▮	SLOW
▶▶	F.F.	↓	SLOW DOWN
▶	PLAY	◀◀	REWIND
●	REC.	X 2	SPEED
●	A. DUB.	▶▷	S. FF.
▮▮	S / P	◁◀	S.REW
▮	FRAME ADV.	⏏	EJECT
⬆	SLOW UP		

NOTE UNLESS OTHERWISE SPECIFIED,

1 ALL RESISTANCE VALUES ARE IN OHMS 1/4W

2 ALL CAPACITANCE VALUES ARE IN μμF (CERAMIC)

– KEY SEARCH-(B) CIRCUIT SCHEMATIC DIAGRAM–

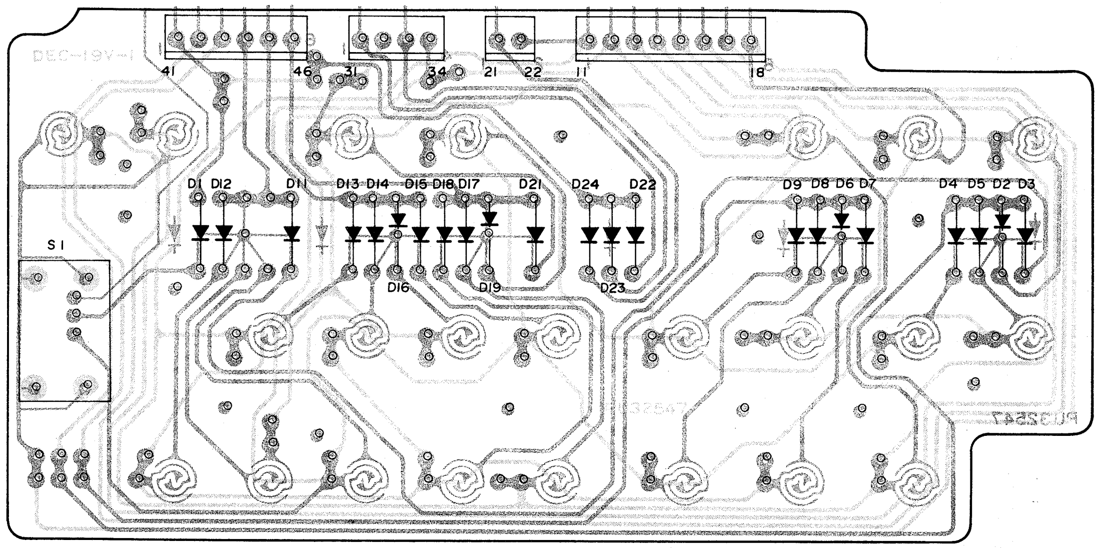

GND
RESET SW
I BUS 0
I BUS 1
I BUS 2
I BUS 3
18 17 16 15 14 13 12 11
TIMER
KEY SD
22 21
DIMMER
KEY SD
LOCK
KEY SD
34 33 32 31
KEY SCAN 0
KEY SCAN 1
KEY SCAN 2
KEY SCAN 3
KEY SCAN 4
KEY SCAN 5
46 45 44 43 42 41
3 5 KEY SEARCH
D24
D23
D22
S22
C. RESET
S17 FINE TUNE D17 –
S13 SAND U D13
S11 PRG. REPEAT D11
S6 PRG. NO D6
S2 COUNTER D2
S18 FINE TUNE D18 +
S14 BAND III D14
S12 STORE D12
S7 CANCEL D7
S3 CLOCK D3
S19 TV PROGRAM D19 –
S15 CH SET MODE D15
S8 SET D8
S4 PROGRAM D4
S1
D1
MANUAL
AUTO
S21 TV PROGRAM D21 +
S16 BAND I D16
S9 SELECT D9
S5 CLOCK SET D5

NOTE

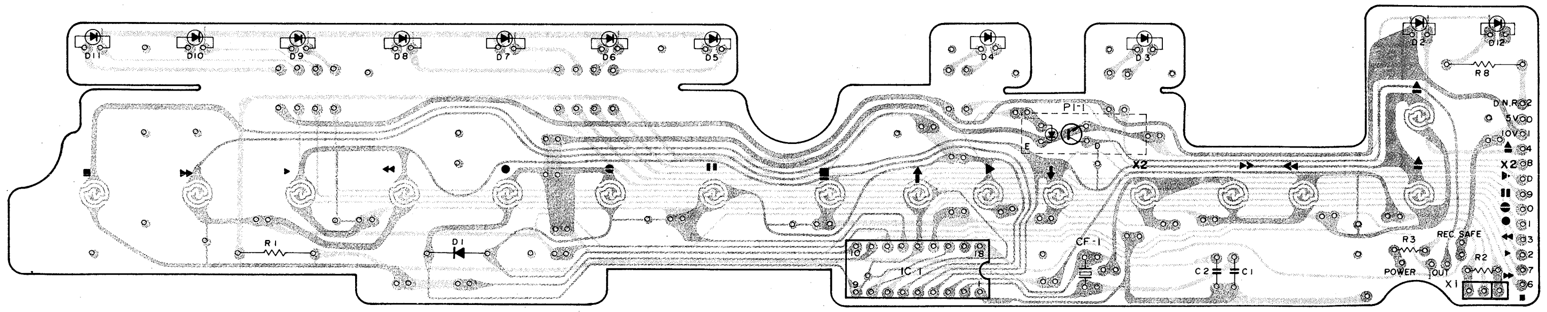
ALL DIODE ARE 1S2473

S2～S24 ARE CONDUCTIVE RUBBER SW

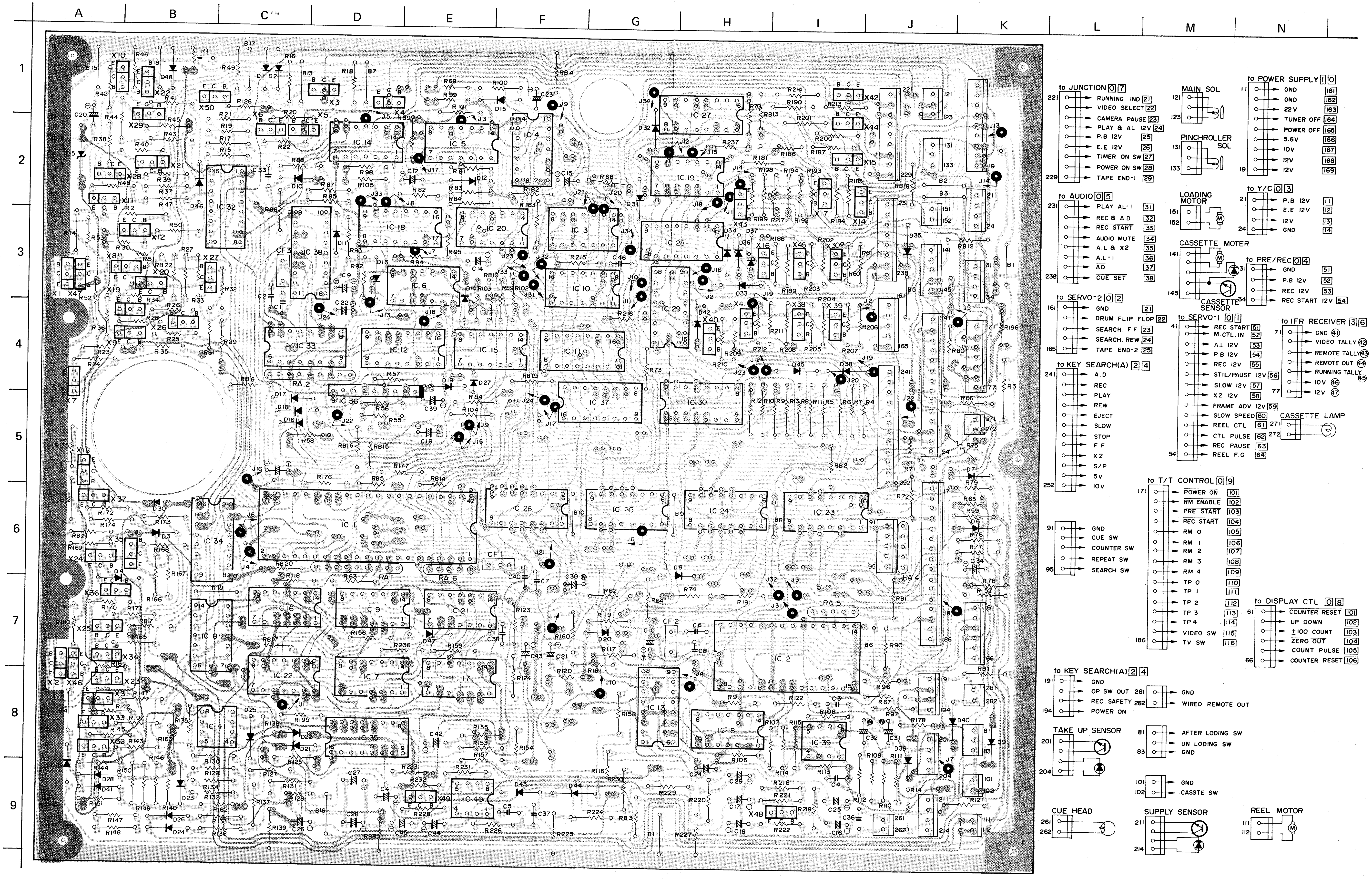
– KEY SERCH-(B) CIRCUIT BOARD –


DEC-19V-1
41
46
34
21
22
11
18
D1 D12
D11
D13 D14
D15 D16 D17
D21
D24
D22
D9 D8 D6 D7
D4 D5 D2 D3
S1
D16
D19
D23
PU3254T

– KEY SEARCH-(A) CIRCUIT BOARD –

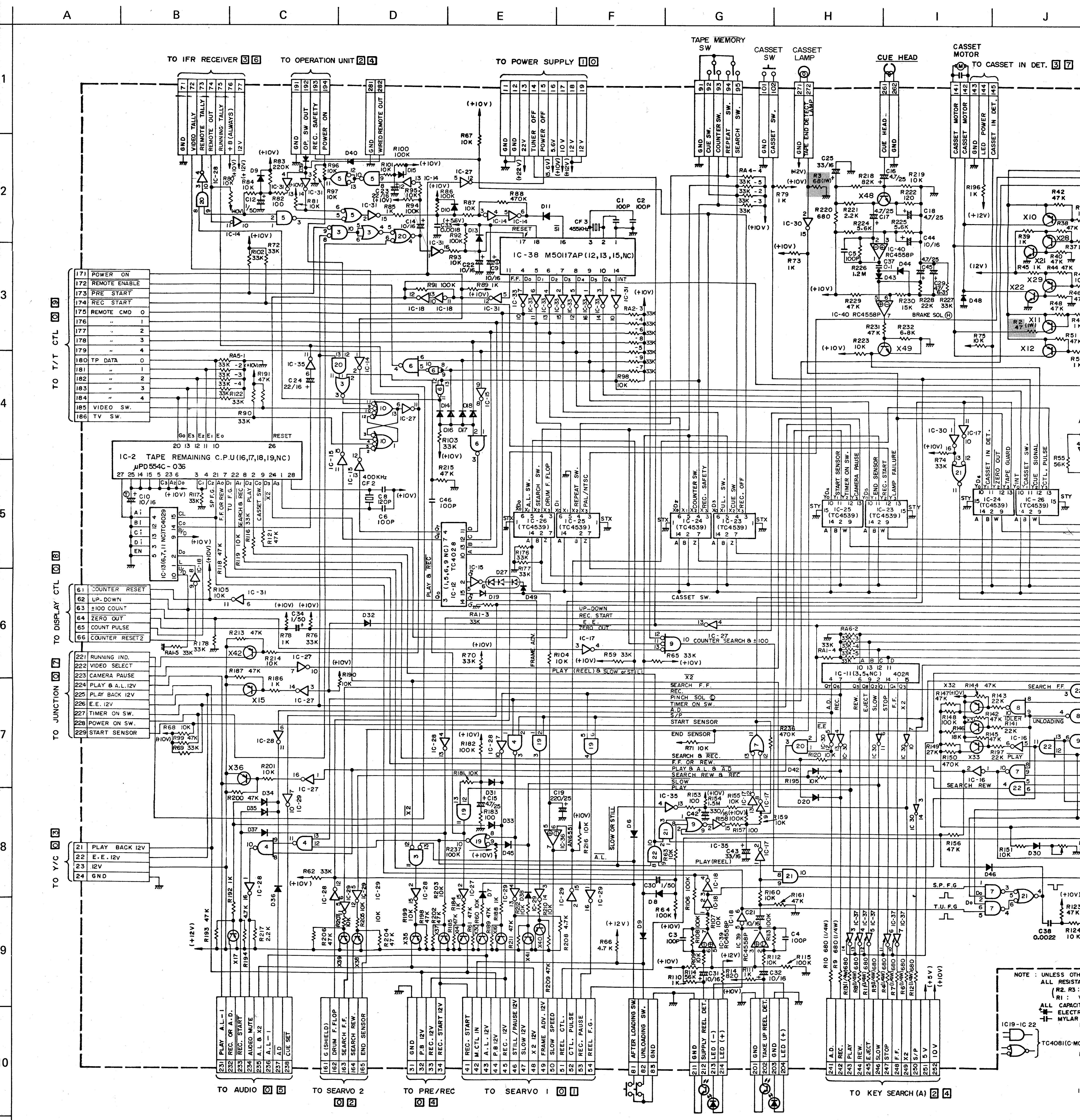

D11
D10
D9
D8
D7
D6
D5
D4
D3
D2
D12
R8
R1
D1
IC1
CF-1
C2
C1
X2
R3
R2
REC SAFE
POWER
OUT
X1
NR
5V
10V
X2

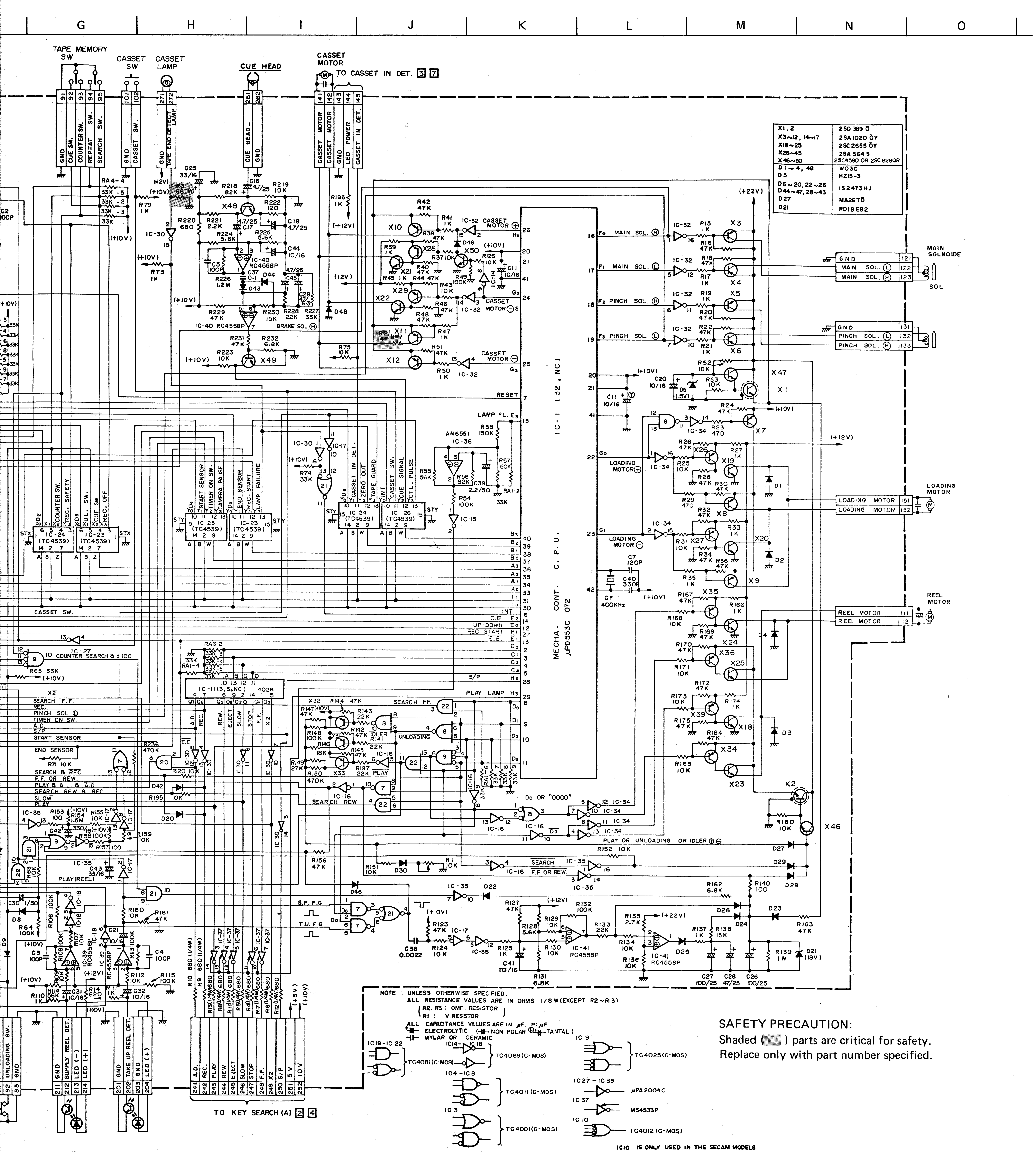
8.12 MECHANISM CONTROL CIRCUIT BOARD



A
B
C
D
E
F
G
H
I
J
K
L
M
N
1
2
3
4
5
6
7
8
9
to JUNCTION 07
RUNNING IND 21
VIDEO SELECT 22
CAMERA PAUSE 23
PLAY & AL 12V 24
P.B 12V 25
E.E 12V 26
TIMER ON SW 27
POWER ON SW 28
TAPE END-1 29
to AUDIO 05
PLAY AL-1 31
REC & A.D 32
REC START 33
AUDIO MUTE 34
A.L & X2 35
A.L-1 36
AD 37
CUE SET 38
to SERVO-2 02
GND 21
DRUM FLIP FLOP 22
SEARCH. F.F 23
SEARCH. REW 24
TAPE END-2 25
to KEY SEARCH(A) 24
A.D
REC
PLAY
REW
EJECT
SLOW
STOP
F.F
X2
S/P
5V
10V
GND
CUE SW
COUNTER SW
REPEAT SW
SEARCH SW
MAIN SOL
PINCHROLLER SOL
LOADING MOTOR
CASSETTE MOTER
CASSETTE SENSOR
to POWER SUPPLY 10
GND 161
GND 162
22V 163
TUNER OFF 164
POWER OFF 165
5.6V 166
10V 167
12V 168
12V 169
to Y/C 03
P.B 12V 11
E.E 12V 12
12V 13
GND 14
to PRE/REC 04
GND 51
P.B 12V 52
REC 12V 53
REC START 12V 54
to SERVO-1 01
REC START 51
M.CTL.IN 52
A.L 12V 53
P.B 12V 54
REC 12V 55
STIL/PAUSE 12V 56
SLOW 12V 57
X2 12V 58
FRAME ADV 12V 59
SLOW SPEED 60
REEL CTL 61
CTL PULSE 62
REC PAUSE 63
REEL F.G 64
to IFR RECEIVER 36
GND 41
VIDEO TALLY 42
REMOTE TALLY 43
REMOTE OUT 44
RUNNING TALLY 45
10V 46
12V 47
CASSETTE LAMP
to T/T CONTROL 09
POWER ON 101
RM ENABLE 102
PRE START 103
REC START 104
RM 0 105
RM 1 106
RM 2 107
RM 3 108
RM 4 109
TP 0 110
TP 1 111
TP 2 112
TP 3 113
TP 4 114
VIDEO SW 115
TV SW 116
to DISPLAY CTL 08
COUNTER RESET 101
UP DOWN 102
±100 COUNT 103
ZERO OUT 104
COUNT PULSE 105
COUNTER RESET 106
to KEY SEARCH(A) 24
GND
OP SW OUT
REC SAFETY
POWER ON
GND
WIRED REMOTE OUT
TAKE UP SENSOR
AFTER LODING SW
UN LODING SW
GND
GND
CASSTE SW
CUE HEAD
SUPPLY SENSOR
REEL MOTOR

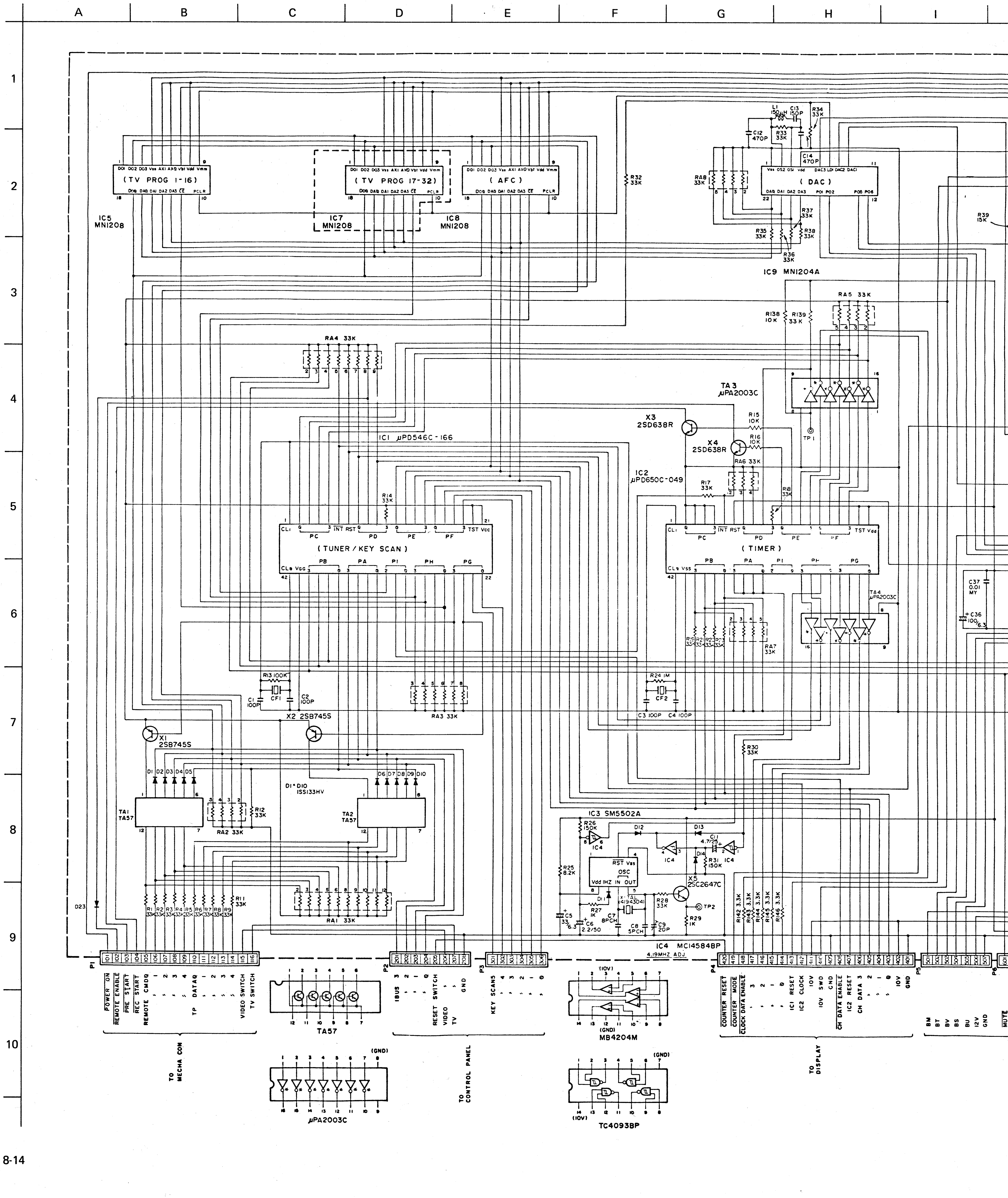
.13 MECHANISM CONTROL CIRCUIT SCHEMATIC DIAGRAM

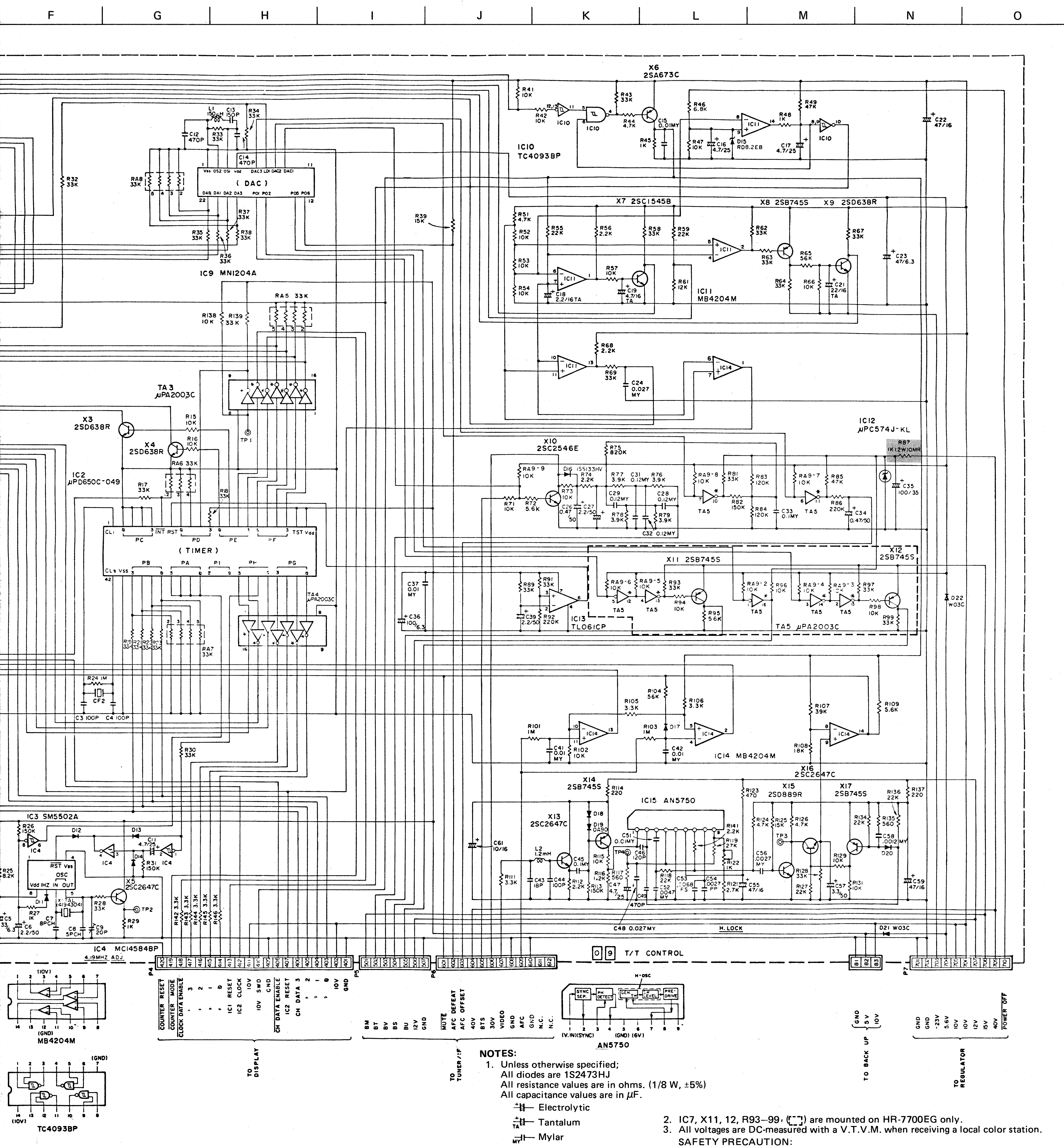

TO IFR RECEIVER 3 6
GND
VIDEO TALLY
REMOTE TALLY
REMOTE OUT
RUNNING TALLY
+B (ALWAYS)
12V
TO OPERATION UNIT 2 4
OP. SW OUT
REC. SAFETY
POWER ON
WIRED REMOTE OUT
TO POWER SUPPLY 1 0
22V
TUNER OFF
POWER OFF
5.6V
10V
12V
TAPE MEMORY SW
CUE SW.
COUNTER SW.
REPEAT SW.
SEARCH SW.
CASSET SW
CASSET LAMP
TAPE END DETECT LAMP
CUE HEAD
CASSET MOTOR
TO CASSET IN DET. 3 7
LED POWER
CASSET IN DET.
TO T/T CTL 0 9
POWER ON
REMOTE ENABLE
PRE START
REC START
REMOTE CMD
TP DATA
VIDEO SW.
TV SW.
IC-2 TAPE REMAINING C.P.U (16,17,18,19,NC)
µPD554C-036
IC-13(6,7,11 NC)TC4029
IC-38 M50117AP (12,13,15,NC)
IC-12 TC4028
IC-11(3,5,NC) 4028
IC-40 RC4558P
IC-39 RC4558P
IC-36 AN6551
TO DISPLAY CTL 0 8
COUNTER RESET
UP-DOWN
±100 COUNT
ZERO OUT
COUNT PULSE
COUNTER RESET2
TO JUNCTION 0 7
RUNNING IND.
VIDEO SELECT
CAMERA PAUSE
PLAY B A.L.12V
PLAY BACK 12V
E.E. 12V
TIMER ON SW.
POWER ON SW.
START SENSOR
TO Y/C 0 3
PLAY BACK 12V
E.E. 12V
12V
GND
TO AUDIO 0 5
PLAY A.L.-1
REC. OR A.D.
REC. START
AUDEO MUTE
A.L & X2
A.L-1
AD
CUE SET
TO SEARVO 2 0 2
G (SHIELD)
DRUM F.FLOP
SEARCH F.F.
SEARCH REW.
END SENSOR
TO PRE/REC 0 4
P.B 12V
REC. 12V
REC. START 12V
TO SEARVO 1 0 1
REC. START
M.CTL IN
A.L. 12V
P.B 12V
REC. 12V
STILL/PAUSE 12V
SLOW 12V
X2 12V
FRAME ADV. 12V
SLOW SPEED
REEL CTL.
CTL. PULSE
REC. PAUSE
REEL F.G.
AFTER LOADING SW.
UNLOADING SW.
SUPPLY REEL DET.
LED (-)
LED (+)
TAKE UP REEL DET.
TO KEY SEARCH (A) 2 4
A.D.
REC.
PLAY
REW.
EJECT
SLOW
STOP
F.F.
X2
S/P
5V
10V
NOTE : UNLESS OTH
ALL RESISTA
ALL CAPACIT
ELECTR
MYLAR
TC4081(C-MO
IC19-IC22
BRAKE SOL.
CASSET SW.
A.L. SW.
SEARCH SW.
DRUM F. FLOP
REPEAT SW.
PAL/NTSC
COUNTER SW.
REC. SAFETY
CUE SW
REC. OFF
START SENSOR
TIMER ON SW.
CAMERA PAUSE
END SENSOR
LAMP FAILURE
CASSET IN DET.
ZERO OUT
TAPE GUARD
CASSET SW.
CUE SIGNAL
CTL. PULSE
PLAY & REC
FRAME ADV.
SLOW OR STILL
COUNTER SEARCH & ±100
SEARCH F.F.
PINCH SOL
END SENSOR
SEARCH & REC.
F.F. OR REW.
PLAY & A.L. & A.D
SEARCH REW & REC
UNLOADING
SEARCH REW
S.P. F.G
T.U. F.G
A B C D E F G H I J
1 2 3 4 5 6 7 8 9 0


G
H
I
J
K
L
M
N
O
TAPE MEMORY SW
CASSET SW
CASSET LAMP
CUE HEAD
CASSET MOTOR
TO CASSET IN DET. 3 7
91 GND
92 CUE SW.
93 COUNTER SW.
94 REPEAT SW.
95 SEARCH SW.
101 GND
102 CASSET SW.
271 GND
272 TAPE END DETECT LAMP
261 CUE HEAD
262 GND
141 CASSET MOTOR
142 CASSET MOTOR
143 GND
144 LED POWER
145 CASSET IN DET.
X1, 2 2SD 389 Ō
X3~12, 14~17 2SA1020 ŌY
X18~25 2SC2655 ŌY
X26~45 2SA 564 S
X46~50 2SC4580 OR 2SC828QR
D1~4, 48 W03C
D5 HZ15-3
D6~20, 22~26 D44~47, 28~43 1S2473HJ
D27 MA26TŌ
D21 RD18EB2
MAIN SOLNOIDE
121 GND
122 MAIN SOL. Ⓛ
123 MAIN SOL. Ⓗ
SOL
131 GND
132 PINCH SOL. Ⓛ
133 PINCH SOL. Ⓗ
LOADING MOTOR
151 LOADING MOTOR
152 LOADING MOTOR
REEL MOTOR
111 REEL MOTOR
112 REEL MOTOR
MECHA. CONT. C.P.U.
μPD553C 072
IC-1 (32, NC)
F0 MAIN SOL. Ⓗ
F1 MAIN SOL. Ⓛ
F2 PINCH SOL. Ⓗ
F3 PINCH SOL. Ⓛ
G0 LOADING MOTOR⊕
G1 LOADING MOTOR⊖
CF1 400KHz
RESET
LAMP FL. E3
CASSET MOTOR ⊕
CASSET MOTOR ⊖ S
CASSET MOTOR ⊖
BRAKE SOL.Ⓗ
IC-40 RC4558P
AN6551 IC-36
START SENSOR
TIMER ON SW.
CAMERA PAUSE
END SENSOR
REC. START
LAMP FAILURE
CASSET IN DET.
ZERO OUT
TAPE GUARD
INT
CASSET SW.
CUE SIGNAL
CTL. PULSE
IC-25 (TC4539)
IC-23 (TC4539)
IC-24 (TC4539)
IC-26 (TC4539)
COUNTER SW.
REC. SAFETY
PUL. SW.
CUE SW.
REC. OFF
CASSET SW.
IC-27 COUNTER SEARCH 8 ±100
IC-11 (13, 5, NC) 4028
INT
CUE
UP-DOWN
REC START
T.E.
S/P
PLAY LAMP
SEARCH F.F.
UNLOADING
IDLER
PLAY
SEARCH REW
Do OR "0000"
PLAY OR UNLOADING OR IDLER ⊕⊖
SEARCH
F.F. OR REW.
S.P.F.G
T.U.F.G
IC-41 RC4558P
IC-39 RC4558P
PLAY (REEL)
X2
SEARCH F.F.
REC.
PINCH SOL Ⓛ
TIMER ON SW.
A.D.
S/P
START SENSOR
END SENSOR
SEARCH & REC.
F.F. OR REW.
PLAY & A.L & A.D
SEARCH REW & REC
SLOW
PLAY
82 UNLOADING SW.
83 GND
211 GND
212 SUPPLY REEL DET.
213 LED (−)
214 LED (+)
201 GND
202 TAKE UP REEL DET.
203 GND
204 LED (+)
241 A.D.
242 REC.
243 PLAY
244 REW.
245 EJECT
246 SLOW
247 STOP
248 F.F.
249 X2
250 S/P
251 5V
252 10V
TO KEY SEARCH (A) 2 4
NOTE : UNLESS OTHERWISE SPECIFIED;
ALL RESISTANCE VALUES ARE IN OHMS 1/8W (EXCEPT R2~R13)
R2, R3 : OMF. RESISTOR
R1 : V.RESISTOR
ALL CAPACITANCE VALUES ARE IN μF, P: μμF
ELECTROLYTIC NON POLAR TANTAL
MYLAR OR CERAMIC
IC19-IC22 TC4081 (C-MOS)
IC14-IC18 TC4069 (C-MOS)
IC4-IC8 TC4011 (C-MOS)
IC3 TC4001 (C-MOS)
IC9 TC4025 (C-MOS)
IC27-IC35 μPA2004C
IC37 M54533P
IC10 TC4012 (C-MOS)
IC10 IS ONLY USED IN THE SECAM MODELS

SAFETY PRECAUTION:
Shaded ( ) parts are critical for safety.
Replace only with part number specified.

8.14 TUNER AND TIMER (T/T) CIRCUIT SCHEMATIC DIAGRAM


A
B
C
D
E
F
G
H
I
1
2
3
4
5
6
7
8
9
10
IC5 MN1208
(TV PROG 1-16)
IC7 MN1208
(TV PROG 17-32)
IC8 MN1208
(AFC)
R32 33K
IC9 MN1204A
(DAC)
L1 150μH
C13 150P
R34 33K
C12 470P
R33 33K
C14 470P
RA8 33K
R35 33K
R36 33K
R37 33K
R38 33K
R39 15K
RA5 33K
R138 10K
R139 33K
TA3 μPA2003C
TP1
X3 2SD638R
X4 2SD638R
R15 10K
R16 10K
RA6 33K
R17 33K
R8 33K
IC1 μPD546C-166
(TUNER / KEY SCAN)
RA4 33K
R14 33K
IC2 μPD650C-049
(TIMER)
TA4 μPA2003C
RA7 33K
C37 0.01 MY
C36 100/6.3
R13 100K
C1 100P
CF1
C2 100P
X2 2SB745S
RA3 33K
R24 1M
CF2
C3 100P
C4 100P
X1 2SB745S
D1 D2 D3 D4 D5
D6 D7 D8 D9 D10
D1~D10 1SS133HV
TA1 TA57
TA2 TA57
RA2 33K
R12 33K
R11 33K
RA1 33K
D23
R30 33K
IC3 SM5502A
R26 150K
D12
D13
C11 4.7/25
R25 8.2K
R31 150K
X5 2SC2647C
R27 1K
C5 33/6.3
C6 2.2/50
C7 8PCH
X-TAL 4194304
C8 5PCH
C9 20P
R28 33K
R29 1K
TP2
IC4 MC14584BP
4.19MHZ ADJ
R142 3.3K
R143 3.3K
R144 3.3K
R145 3.3K
R146 3.3K
P1
POWER ON
REMOTE ENABLE
PRE START
REC START
REMOTE CMD0
TP DATA0
VIDEO SWITCH
TV SWITCH
TO MECHA CON
P2
IBUS 3
RESET SWITCH
VIDEO
TV
GND
TO CONTROL PANEL
P3
KEY SCAN5
P4
COUNTER RESET
COUNTER MODE
CLOCK DATA ENABLE
IC1 RESET
IC2 CLOCK
10V
10V SWD
GND
CH DATA ENABLE
IC2 RESET
CH DATA 3
TO DISPLAY
P5
BM
BT
BV
BS
BU
12V
GND
MUTE
TA57
μPA2003C
MB4204M
TC4093BP
(10V)
(GND)


F
G
H
I
J
K
L
M
N
O
X6 2SA673C
IC10 TC4093BP
IC9 MN1204A
(DAC)
RA8 33K
RA5 33K
X7 2SC1545B
X8 2SB745S
X9 2SD638R
IC11 MB4204M
TA3 μPA2003C
TP1
X3 2SD638R
X4 2SD638R
RA6 33K
IC2 μPD650C-049
(TIMER)
TA4 μPA2003C
RA7 33K
R24 1M
CF2
C3 100P
C4 100P
R30 33K
IC12 μPC574J-KL
R87 1K(2W)OMR
X10 2SC2546E
X11 2SB745S
X12 2SB745S
IC13 TL061CP
TA5 μPA2003C
D22 W03C
IC14 MB4204M
X13 2SC2647C
X14 2SB745S
IC15 AN5750
X15 2SD889R
X16 2SC2647C
X17 2SB745S
TP3
TP4
IC3 SM5502A
IC4
OSC
X5 2SC2647C
TP2
IC4 MC14584BP
4.19MHZ ADJ
R142 3.3K
R143 3.3K
R144 3.3K
R145 3.3K
R146 3.3K
C48 0.027MY
H.LOCK
D21 W03C
0 9 T/T CONTROL
P4
COUNTER RESET
COUNTER MODE
CLOCK DATA ENABLE
3
2
1
0
IC1 RESET
IC2 CLOCK
10V
10V SWD
GND
CH DATA ENABLE
IC2 RESET
CH DATA 3
2
1
0
10V
GND
TO DISPLAY
P5
BM
BT
BV
BS
BU
12V
GND
P6
MUTE
AFC DEFEAT
AFC OFFSET
40V
BTS
30V
VIDEO
GND
AFC
GND
N.C.
N.C.
TO TUNER/IF
H-OSC
SYNC SEP.
PH DETECT
GEN. SW
SW LEVEL
PRE-DRIVE
(V.IN)(SYNC)
(GND) (6V)
AN5750
GND
5V
10V
TO BACK UP
P7
GND
GND
-23V
5.6V
10V
10V
12V
15V
40V
POWER OFF
TO REGULATOR
(10V)
(GND)
MB4204M
TC4093BP

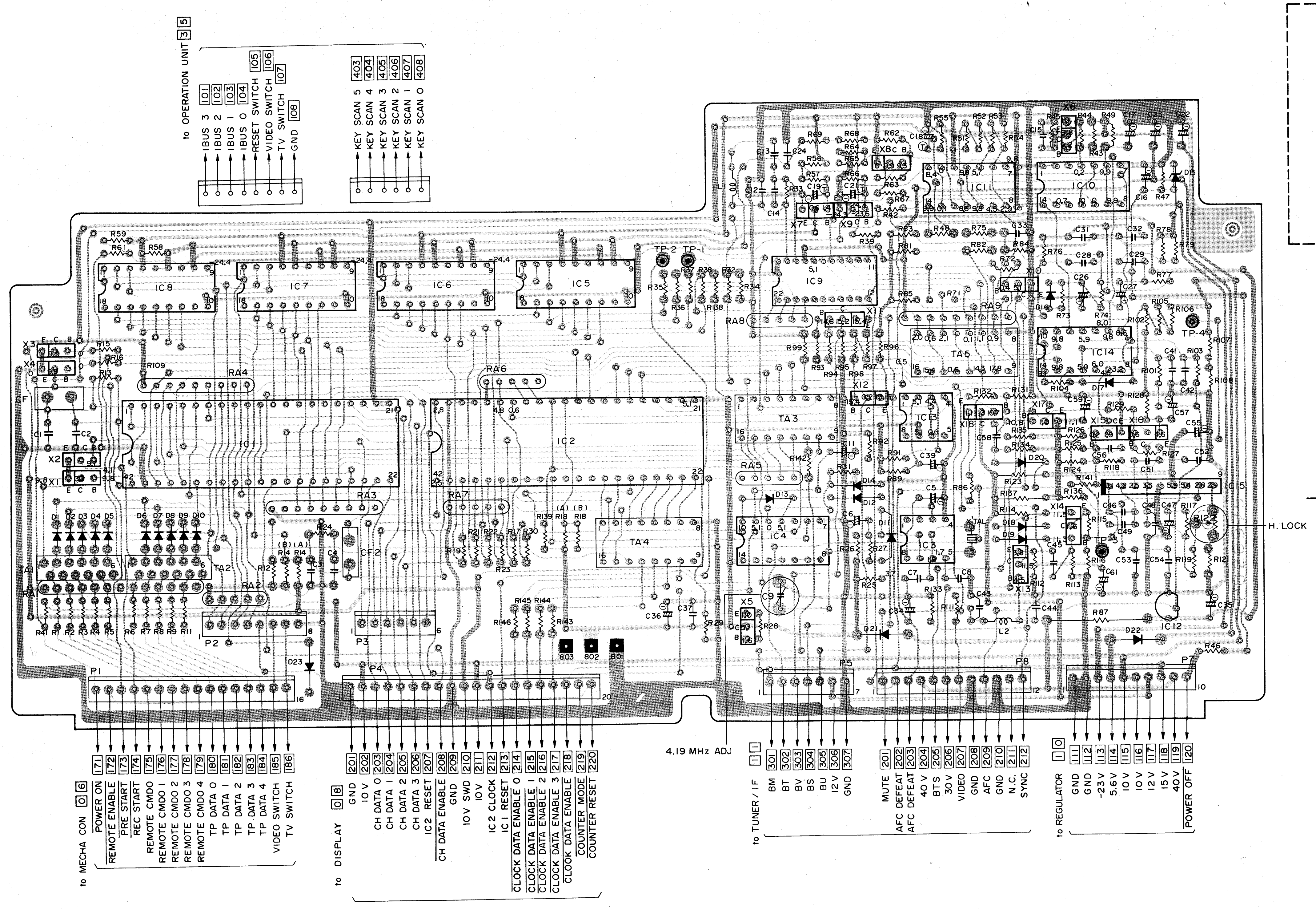
NOTES:

1. Unless otherwise specified;
   All diodes are 1S2473HJ
   All resistance values are in ohms. (1/8 W, ±5%)
   All capacitance values are in μF.
   - Electrolytic
   - Tantalum
   - Mylar
   - Ceramic
2. IC7, X11, 12, R93–99, (⬚) are mounted on HR-7700EG only.
3. All voltages are DC-measured with a V.T.V.M. when receiving a local color station.

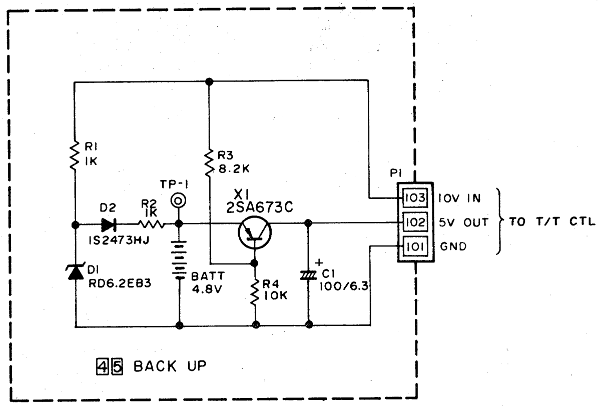
SAFETY PRECAUTION:
Shaded (▨) parts are critical for safety. Replace only with part number specified.

8.15 TUNER AND TIMER (T/T) CIRCUIT BOARD

– TUNER AND TIMER (T/T) CIRCUIT BOARD –

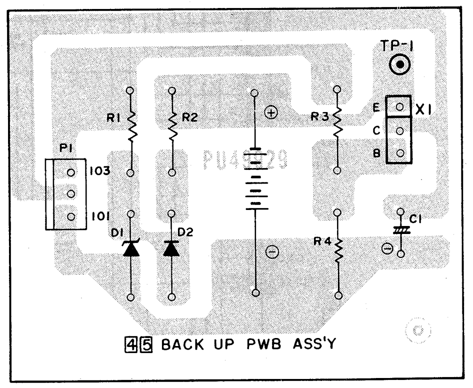

to OPERATION UNIT 35
IBUS 3 101
IBUS 2 102
IBUS 1 103
IBUS 0 104
RESET SWITCH 105
VIDEO SWITCH 106
TV SWITCH 107
GND 108
KEY SCAN 5 403
KEY SCAN 4 404
KEY SCAN 3 405
KEY SCAN 2 406
KEY SCAN 1 407
KEY SCAN 0 408
IC8
IC7
IC6
IC5
IC9
IC11
IC10
IC14
IC1
IC2
IC13
IC3
IC4
IC15
IC12
TA1
TA2
TA3
TA4
TA5
RA1
RA2
RA3
RA4
RA5
RA6
RA7
RA8
RA9
CF
CF2
TP-1
TP-2
TP-3
TP-4
X'TAL
H. LOCK
803
802
801
P1
P2
P3
P4
P5
P7
P8
4.19 MHz ADJ
to MECHA CON 06
POWER ON 171
REMOTE ENABLE 172
PRE START 173
REC START 174
REMOTE CMDO 175
REMOTE CMDO 1 176
REMOTE CMDO 2 177
REMOTE CMDO 3 178
REMOTE CMDO 4 179
TP DATA 0 180
TP DATA 1 181
TP DATA 2 182
TP DATA 3 183
TP DATA 4 184
VIDEO SWITCH 185
TV SWITCH 186
to DISPLAY 08
GND 201
10 V 202
CH DATA 0 203
CH DATA 1 204
CH DATA 2 205
CH DATA 3 206
IC2 RESET 207
CH DATA ENABLE 208
GND 209
10V SWD 210
10V 211
IC2 CLOCK 212
IC1 RESET 213
CLOCK DATA ENABLE 0 214
CLOCK DATA ENABLE 1 215
CLOCK DATA ENABLE 2 216
CLOCK DATA ENABLE 3 217
CLOOK DATA ENABLE 218
COUNTER MODE 219
COUNTER RESET 220
to TUNER / IF 11
BM 301
BT 302
BV 303
BS 304
BU 305
12 V 306
GND 307
MUTE 201
AFC DEFEAT 202
AFC DEFEAT 203
40 V 204
BTS 205
30 V 206
VIDEO 207
GND 208
AFC 209
GND 210
N.C. 211
SYNC 212
to REGULATOR 10
GND 111
GND 112
-23 V 113
5.6 V 114
10 V 115
10 V 116
12 V 117
15 V 118
40 V 119
POWER OFF 120

– BACK UP CIRCUIT SCHEMATIC DIAGRAM –


R1
1K
R3
8.2K
TP-1
X1
2SA673C
D2
R2
1K
1S2473HJ
D1
RD6.2EB3
BATT
4.8V
R4
10K
+
C1
100/6.3
P1
103 10V IN
102 5V OUT
101 GND
TO T/T CTL
45 BACK UP

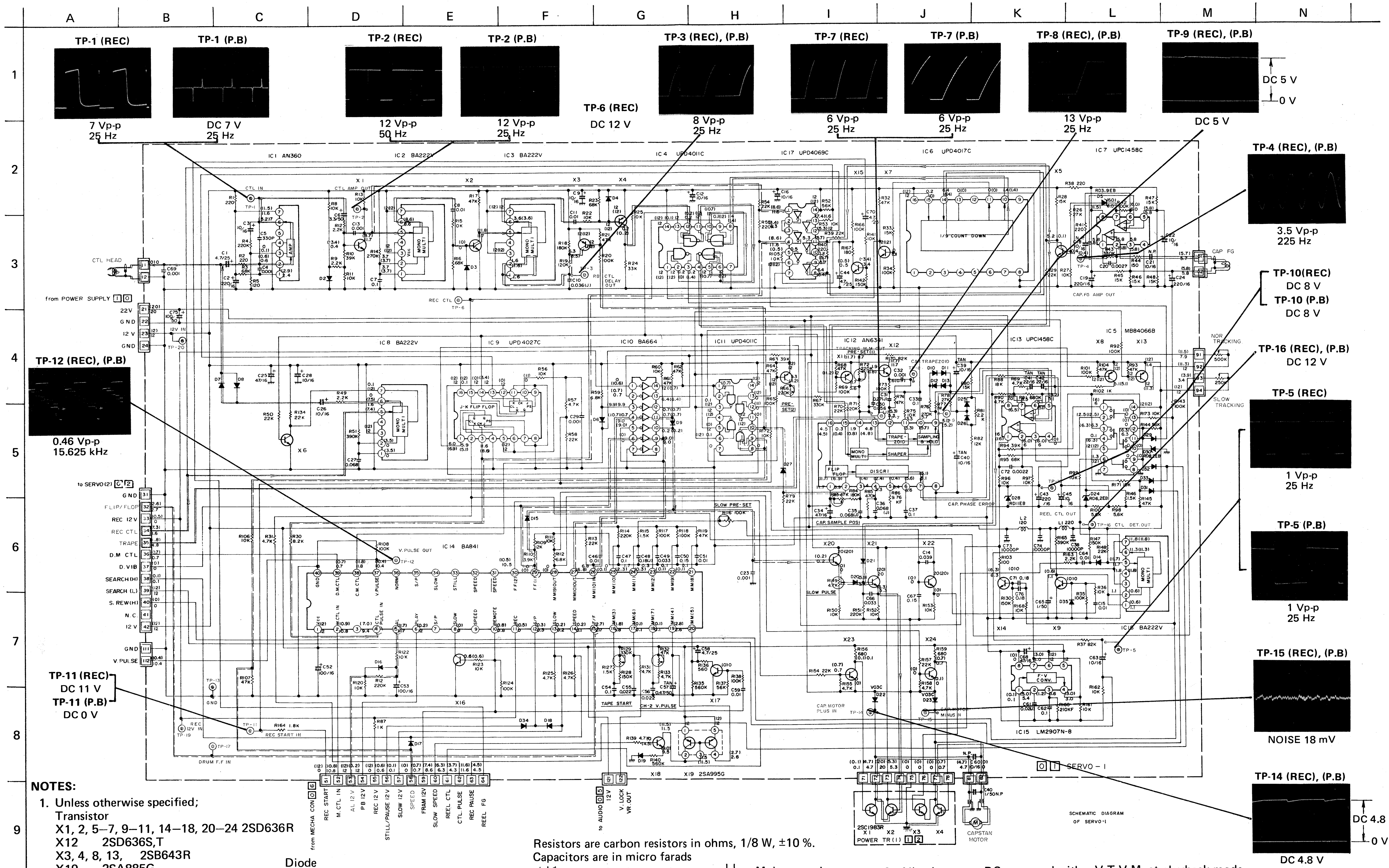
(NOTE)
UNLESS OTHERWISE SPECIFIED;
ALL RESISTANCE VALUES ARE IN OHMS. 1/8W
CAPACITANCE VALUE IS IN μF.

– BACK UP CIRCUIT BOARD –


TP-1
E
C
B
X1
R1
R2
R3
R4
P1
103
101
D1
D2
C1
PU49129

45 BACK UP PWB ASS'Y

8.16 SERVO-1 CIRCUIT SCHEMATIC DIAGRAM


A
B
C
D
E
F
G
H
I
J
K
L
M
N
1
2
3
4
5
6
7
8
9
TP-1 (REC)
7 Vp-p
25 Hz
TP-1 (P.B)
DC 7 V
25 Hz
TP-2 (REC)
12 Vp-p
50 Hz
TP-2 (P.B)
12 Vp-p
25 Hz
TP-6 (REC)
DC 12 V
TP-3 (REC), (P.B)
8 Vp-p
25 Hz
TP-7 (REC)
6 Vp-p
25 Hz
TP-7 (P.B)
6 Vp-p
25 Hz
TP-8 (REC), (P.B)
13 Vp-p
25 Hz
TP-9 (REC), (P.B)
DC 5 V
0 V
DC 5 V
TP-4 (REC), (P.B)
3.5 Vp-p
225 Hz
TP-10(REC)
DC 8 V
TP-10 (P.B)
DC 8 V
TP-16 (REC), (P.B)
DC 12 V
TP-5 (REC)
1 Vp-p
25 Hz
TP-5 (P.B)
1 Vp-p
25 Hz
TP-15 (REC), (P.B)
NOISE 18 mV
TP-14 (REC), (P.B)
DC 4.8 V
0 V
DC 4.8 V
TP-12 (REC), (P.B)
0.46 Vp-p
15.625 kHz
TP-11 (REC)
DC 11 V
TP-11 (P.B)
DC 0 V
IC1 AN360
IC2 BA222V
IC3 BA222V
IC4 UPD4011C
IC17 UPD4069C
IC6 UPD4017C
IC7 UPC1458C
IC8 BA222V
IC9 UPD4027C
IC10 BA664
IC11 UPD4011C
IC12 AN6341
IC13 UPC1458C
IC5 MB84066B
IC14 BA841
IC15 LM2907N-8
IC16 BA222V
1/9 COUNT DOWN
J-K FLIP FLOP
MONO MULTI
CTL HEAD
CAP FG
from POWER SUPPLY
22V
GND
12 V
GND
to SERVO(2)
GND
FLIP/FLOP
REC 12V
REC CTL
TRAPE
D.M CTL
D.VIB
SEARCH(H)
SEARCH(L)
S.REW(H)
N.C
12 V
GND
V.PULSE
NOR TRACKING
SLOW TRACKING
DRUM F.F IN
REC START IN
TAPE START
CH-2 V.PULSE
SLOW PULSE
SLOW PRE-SET
CAP SAMPLE POSI
CAP.PHASE ERROR
CAP.FG AMP OUT
REEL CTL OUT
CTL DET.OUT
CAP.MOTOR PLUS IN
CAP.MOTOR MINUS IN
from MECHA CON
REC START
M.CTL IN
AL 12 V
PB 12 V
REC 12 V
STILL/PAUSE 12 V
SLOW 12 V
SPEED
FRAM 12V
SLOW SPEED
REEL CTL
CTL PULSE
REC PAUSE
REEL FG
to AUDIO
12V
V.LOCK
VR OUT
SERVO - 1
2SC1983R
X1
X2
X3
X4
POWER TR(1)
CAPSTAN MOTOR
SCHEMATIC DIAGRAM OF SERVO-1

NOTES:

1. Unless otherwise specified;

Transistor

X1, 2, 5–7, 9–11, 14–18, 20–24 2SD636R

X12 2SD636S,T

X3, 4, 8, 13, 2SB643R

X19 2SA885G

Diode

D2–4, 6–21, 25–27, 29, 31–35 1S2473

Resistors are carbon resistors in ohms, 1/8 W, ±10 %.

Capacitors are in micro farads

Electrolytic capacitor

Ceramic capacitor

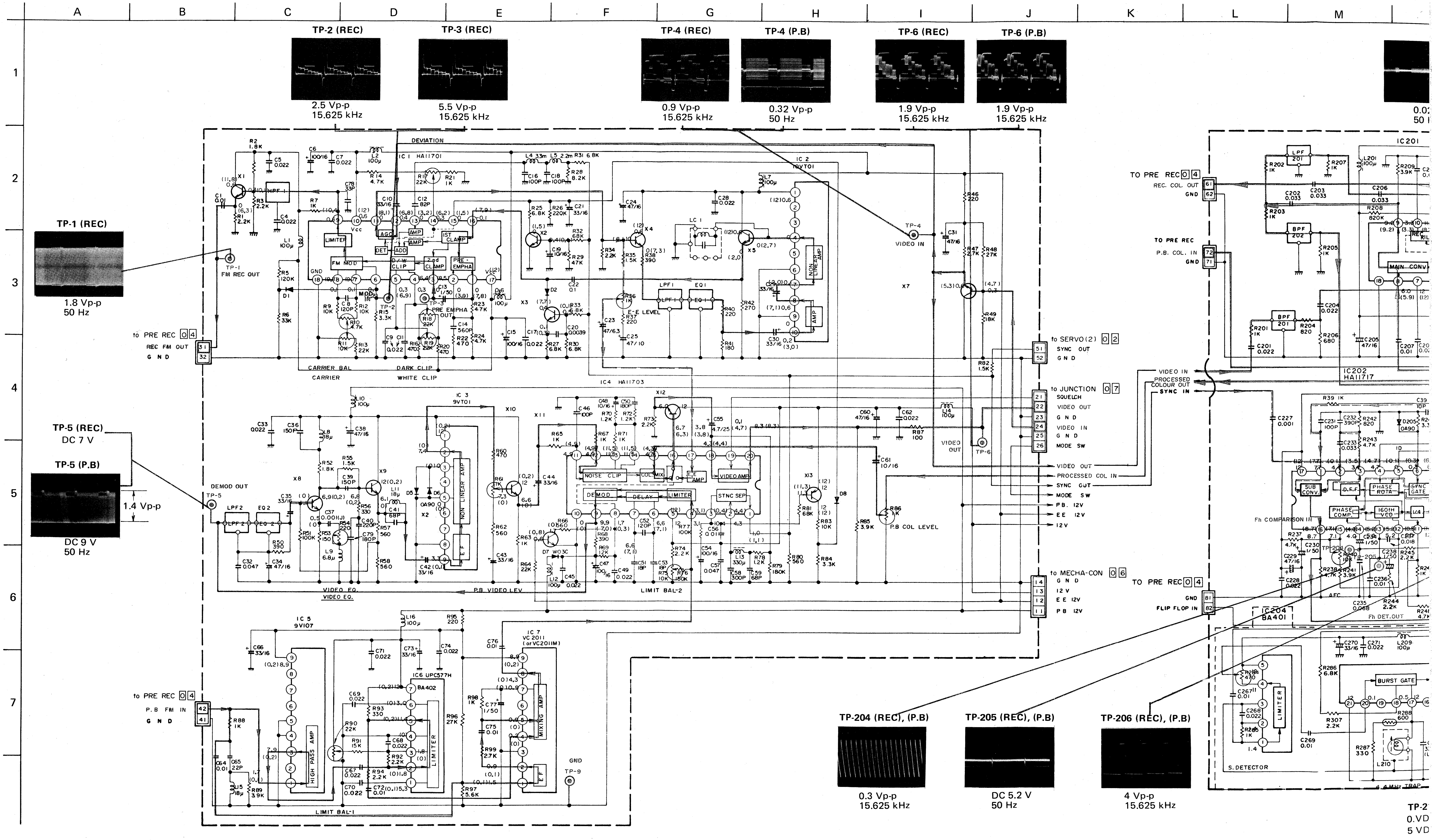
MY Mylar capacitor

TAN Tantalum capacitor

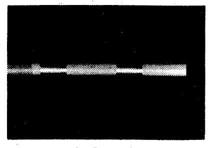
2. All voltages are DC-measured with a V.T.V.M. at playback mode.

( ) represents the DC voltage at record mode.

8.21 LUMINANCE AND CHROMINANCE (Y/C) CIRCUIT SCHEMATIC DIAGARM

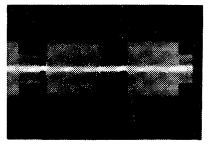

A
B
C
D
E
F
G
H
I
J
K
L
M
1
2
3
4
5
6
7
TP-1 (REC)
1.8 Vp-p
50 Hz
TP-2 (REC)
2.5 Vp-p
15.625 kHz
TP-3 (REC)
5.5 Vp-p
15.625 kHz
TP-4 (REC)
0.9 Vp-p
15.625 kHz
TP-4 (P.B)
0.32 Vp-p
50 Hz
TP-6 (REC)
1.9 Vp-p
15.625 kHz
TP-6 (P.B)
1.9 Vp-p
15.625 kHz
TP-5 (REC)
DC 7 V
TP-5 (P.B)
DC 9 V
50 Hz
1.4 Vp-p
TP-204 (REC), (P.B)
0.3 Vp-p
15.625 kHz
TP-205 (REC), (P.B)
DC 5.2 V
50 Hz
TP-206 (REC), (P.B)
4 Vp-p
15.625 kHz
DEVIATION
IC 1 HA11701
IC 2 9VT01
IC 3 9VT01
IC4 HA11703
IC 5 9V107
IC6 UPC577H
IC 7 VC 2011 (or VC2011M)
IC201
IC202 HA11717
IC204 BA401
BA402
TP-1 FM REC OUT
to PRE REC 04
REC FM OUT
GND
LIMITER
FM MOD
AGC
DET
ADD
AMP
1st CLAMP
2nd CLAMP
D/W CLIP
PRE-EMPHA
PRE EMPHA OUT
CARRIER BAL
CARRIER
DARK CLIP
WHITE CLIP
LPF1
EQ1
E-E LEVEL
NON LINEAR AMP
TP-4 VIDEO IN
to SERVO(2) 02
SYNC OUT
to JUNCTION 07
SQUELCH
VIDEO OUT
VIDEO IN
MODE SW
NOISE CLIP
COL MIX
E-E AMP
VIDEO AMP
DEMOD
DELAY
LIMITER
SYNC SEP
LIMIT BAL-2
P.B COL LEVEL
VIDEO OUT
TP-6
DEMOD OUT
TP-5
LPF2
EQ2
VIDEO EQ.
P.B VIDEO LEV
VIDEO OUT
PROCESSED COL IN
SYNC OUT
MODE SW
P.B. 12V
EE 12V
12V
to MECHA-CON 06
12 V
EE 12V
PB 12V
to PRE REC 04
P.B FM IN
HIGH PASS AMP
LIMITER
MIXING AMP
E.F
GND
TP-9
LIMIT BAL-1
TO PRE REC 04
REC. COL. OUT
TO PRE REC
P.B. COL. IN
LPF 201
BPF 202
BPF 201
MAIN CONV
VIDEO IN
PROCESSED COLOUR OUT
SYNC IN
SUB CONV.
D.F.F
PHASE ROTA
SYNC GATE
PHASE COMP.
160fH VCO
Fh COMPARISON IN
AFC
Fh DET.OUT
TO PRE REC 04
FLIP FLOP IN
BURST GATE
S. DETECTOR
4.4MHz TRAP
TP-2
0.VD
5 VD

L M N O P Q R S T U V W X



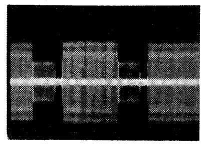
0.02 Vp-p
50 Hz

TP-201 (P.B)



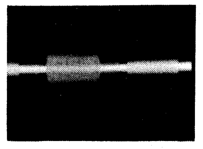
0.07 Vp-p
50 Hz

TP-202 (P.B)



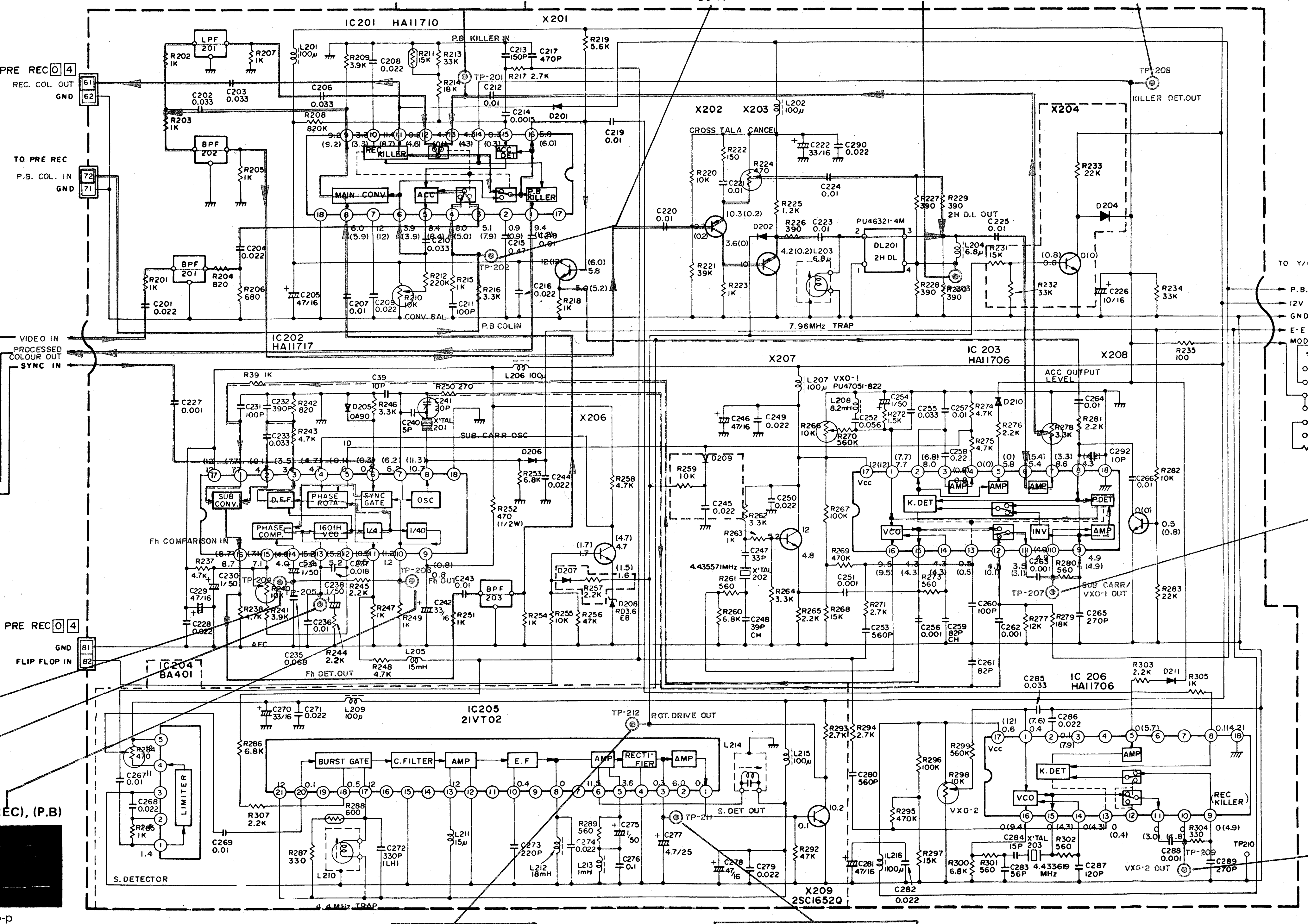
0.1 Vp-p
50 Hz

TP-203 (P.B)

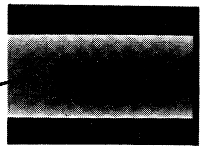


0.08 Vp-p
50 Hz

TP-208 (REC), (P.B)
DC 4.2 V
B/W 0 V

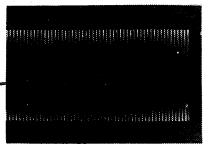

IC201 HA11710
X201
IC202 HA11717
IC 203 HA11706
IC 206 HA11706
IC205 2IVT02
IC204 BA401
X209 2SC1652Q
X202
X203
X204
X206
X207
X208
PRE REC 0 4
REC. COL. OUT
GND
TO PRE REC
P.B. COL. IN
GND
VIDEO IN
PROCESSED COLOUR OUT
SYNC IN
PRE REC 0 4
GND
FLIP FLOP IN
TO Y/C
P.B. 12V
12V
GND
E-E 12V
MODE SW
CH. SET 12V
AUTO
COL
B/W
CH. SET
LPF 201
BPF 202
BPF 201
BPF 203
MAIN CONV
ACC
P.B KILLER
REC KILLER
ACC DET
P.B KILLER IN
KILLER DET.OUT
CONV. BAL
P.B COLIN
CROSS TALK CANCEL
DL201 2H DL
PU46321-4M
2H D.L OUT
7.96MHz TRAP
SUB CARR OSC
X'TAL 201
SUB CONV
D.F.F.
PHASE ROTA
SYNC GATE
OSC
PHASE COMP
160fH VCO
1/4
1/40
Fh COMPARISON IN
Fh OUT
AFC
Fh DET.OUT
VXO-1 PU47051-822
ACC OUTPUT LEVEL
K.DET
VCO
INV
AMP
P.DET
SUB CARR/VXO-1 OUT
4.435571MHz
TP-201
TP-202
TP-203
TP-204
TP-205
TP-207
TP 208
TP-209
TP210
TP-211
TP-212
ROT. DRIVE OUT
BURST GATE
C.FILTER
E.F
RECTI-FIER
S.DET OUT
LIMITER
S.DETECTOR
4.4MHz TRAP
VXO-2
VXO-2 OUT
X'TAL 203 4.433619 MHz
REC KILLER
Vcc

TP-207 (REC), (P.B)



0.6 Vp-p
4.435571 MHz

TP-209 (REC)



0.45 Vp-p
4.433619 MHz

EC), (P.B)

-p
25 kHz

TP-212 (REC)
0.VDC(SECAM IN)
5 VDC(PAL IN)

TP-212 (P.B)
0 VDC(SECAM SIGNAL)
5 VDC(PAL SIGNAL)

TP-211 (REC)
0.9 VDC (AL SIGNAL IN)
11 VDC (SECAM SIGNAL IN)

TP-211 (P.B)
11 VDC(SECAM SIGNAL)
0 VDC(PAL SIGNAL)

NOTES:

1. Unless otherwise specified;
   Resistance: [Ω], 1/8, carbon resistor
   Capacitance :
   Electrolytic: capacitance value [μF] /working voltage [V]
   Ceramic or Mylar: 1 or higher .....[pF]
   less than 1 ......[μF]
   NPN Transistor 2SC2063Q X8, 9, 207
   2SC2063QR X2, 3, 11, 204, 206, 208
   2SC2063PQ X1, 4, 5, 10, 12, 201
   PNP Transistor 2SA786Q X7, 13, 202, 203
   All diodes are 1S2473HJ
   X294, 209, D202, 294, 207, 209, IC204, 205, R231, 233
   R257, 259, 284–293, 306, 307, C245, 267–279, 291
   L209-215, and TP211, 212 (┌┄┐) are mounted on HR-7700EG only.
2. All voltages are DC-measured with a V,T.V.M. at playback mode.
   ( ) represents the DC voltage at record mode.

8.22 TUNER CIRCUIT SCHEMATIC DIAGRAM

NOTES: 1. Unless otherwise specified transistor

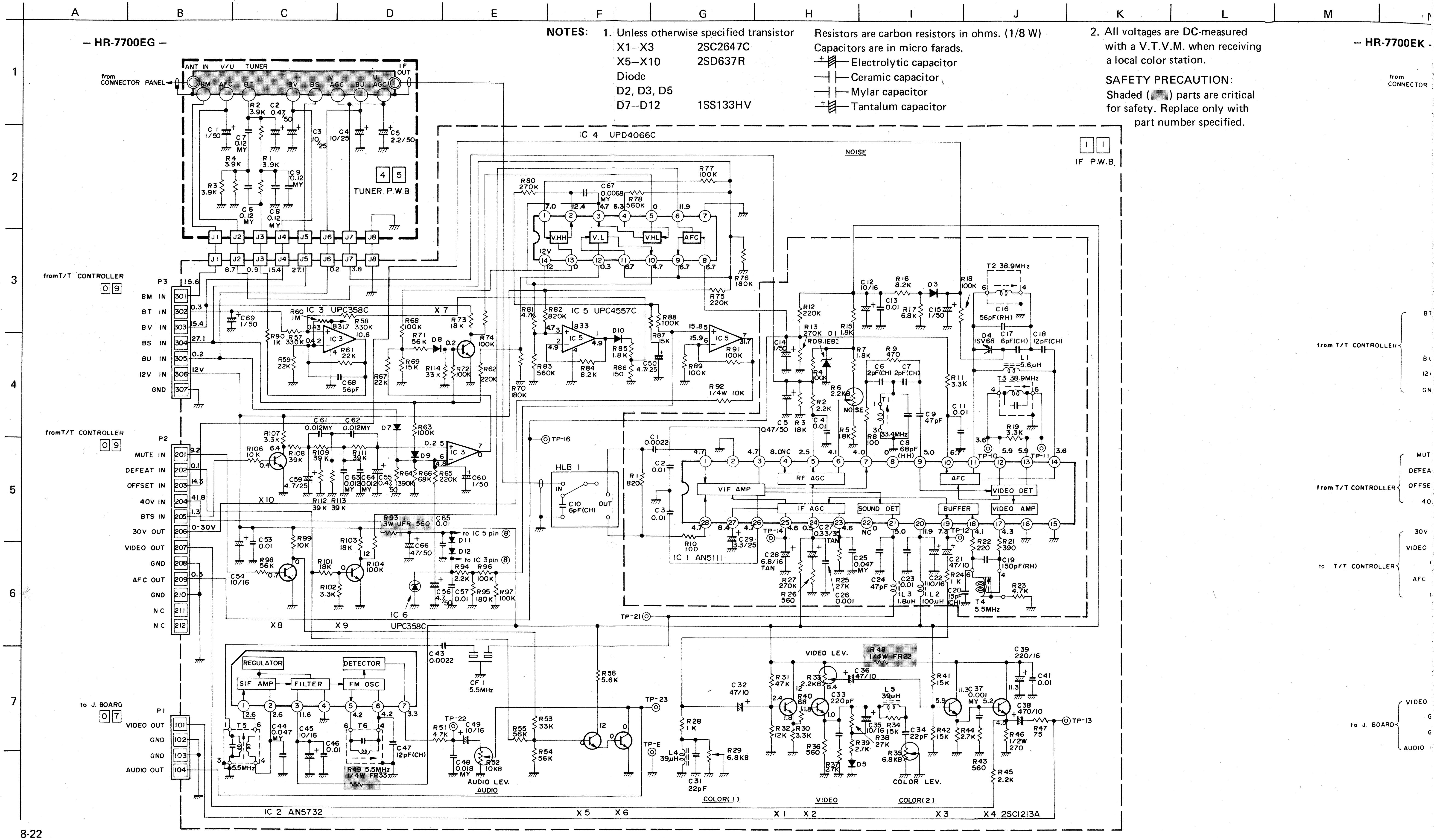
X1–X3	2SC2647C
X5–X10	2SD637R
Diode	
D2, D3, D5	
D7–D12	1SS133HV

Resistors are carbon resistors in ohms. (1/8 W)
Capacitors are in micro farads.

- Electrolytic capacitor
- Ceramic capacitor
- Mylar capacitor
- Tantalum capacitor

2. All voltages are DC-measured with a V.T.V.M. when receiving a local color station.

SAFETY PRECAUTION:
Shaded (▨) parts are critical for safety. Replace only with part number specified.



A
B
C
D
E
F
G
H
I
J
K
L
M
1
2
3
4
5
6
7
– HR-7700EG –
– HR-7700EK
from CONNECTOR PANEL
ANT IN V/U TUNER
IF OUT
BM AFC BT BV BS V AGC BU U AGC
TUNER P.W.B.
4 5
J1 J2 J3 J4 J5 J6 J7 J8
from T/T CONTROLLER
0 9
P3
BM IN
BT IN
BV IN
BS IN
BU IN
12V IN
GND
301 302 303 304 305 306 307
P2
MUTE IN
DEFEAT IN
OFFSET IN
40V IN
BTS IN
30V OUT
VIDEO OUT
GND
AFC OUT
GND
NC
NC
201 202 203 204 205 206 207 208 209 210 211 212
to J. BOARD
0 7
P1
VIDEO OUT
GND
GND
AUDIO OUT
101 102 103 104
IC 4 UPD4066C
IC 3 UPC358C
IC 5 UPC4557C
IC 6 UPC358C
IC 1 AN5111
IC 2 AN5732
V.HH V.L V.HL AFC
NOISE
IF P.W.B.
1 1
HLB 1
IN OUT
TP-16
TP-21
TP-22
TP-23
TP-E
TP-13
TP-14
TP-10
TP-11
TP-12
VIF AMP
RF AGC
IF AGC
SOUND DET
BUFFER
VIDEO AMP
VIDEO DET
AFC
REGULATOR
DETECTOR
SIF AMP
FILTER
FM OSC
T2 38.9MHz
T3 38.9MHz
T4 5.5MHz
T5
T6
CF 1 5.5MHz
R93 3W UFR 560
R48 1/4W FR22
R49 5.5MHz 1/4W FR33
VIDEO LEV.
AUDIO LEV.
COLOR LEV.
AUDIO
COLOR(1)
VIDEO
COLOR(2)
X1 X2 X3 X4 2SC1213A
X5 X6
X7 X8 X9 X10
to IC 5 pin 8
to IC 3 pin 8
from T/T CONTROLLER
to T/T CONTROLLER
to J. BOARD
VIDEO
AFC
AUDIO

L | M | N | O | P | Q | R | S | T | U | V | W | X

DC-measured
when receiving
ion.

AUTION:
rts are critical
ce only with
er specified.

– HR-7700EK –

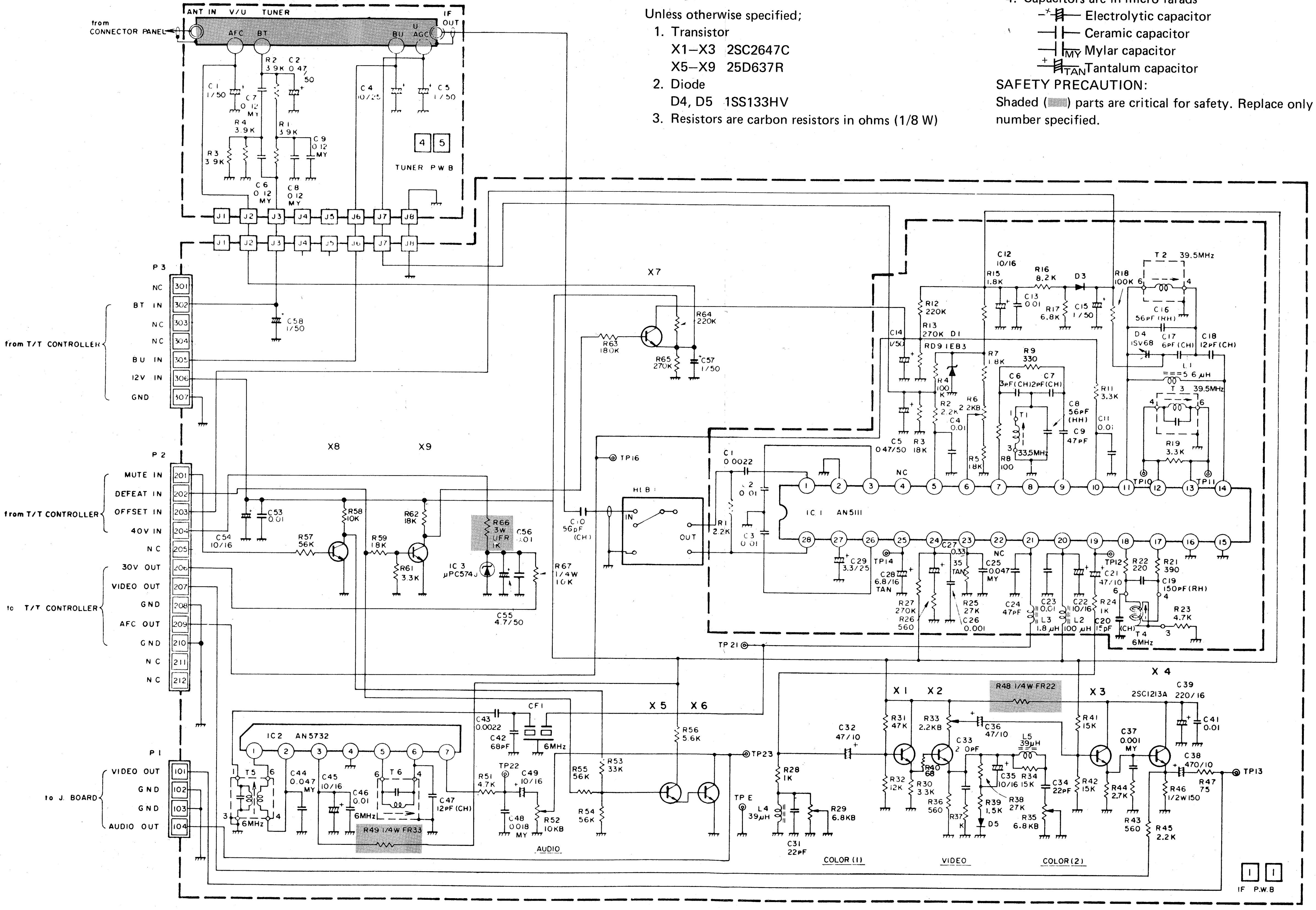
NOTES:

Unless otherwise specified;

1. Transistor
   X1–X3 2SC2647C
   X5–X9 25D637R
2. Diode
   D4, D5 1SS133HV
3. Resistors are carbon resistors in ohms (1/8 W)
4. Capacitors are in micro farads
   - Electrolytic capacitor
   - Ceramic capacitor
   - MY Mylar capacitor
   - TAN Tantalum capacitor

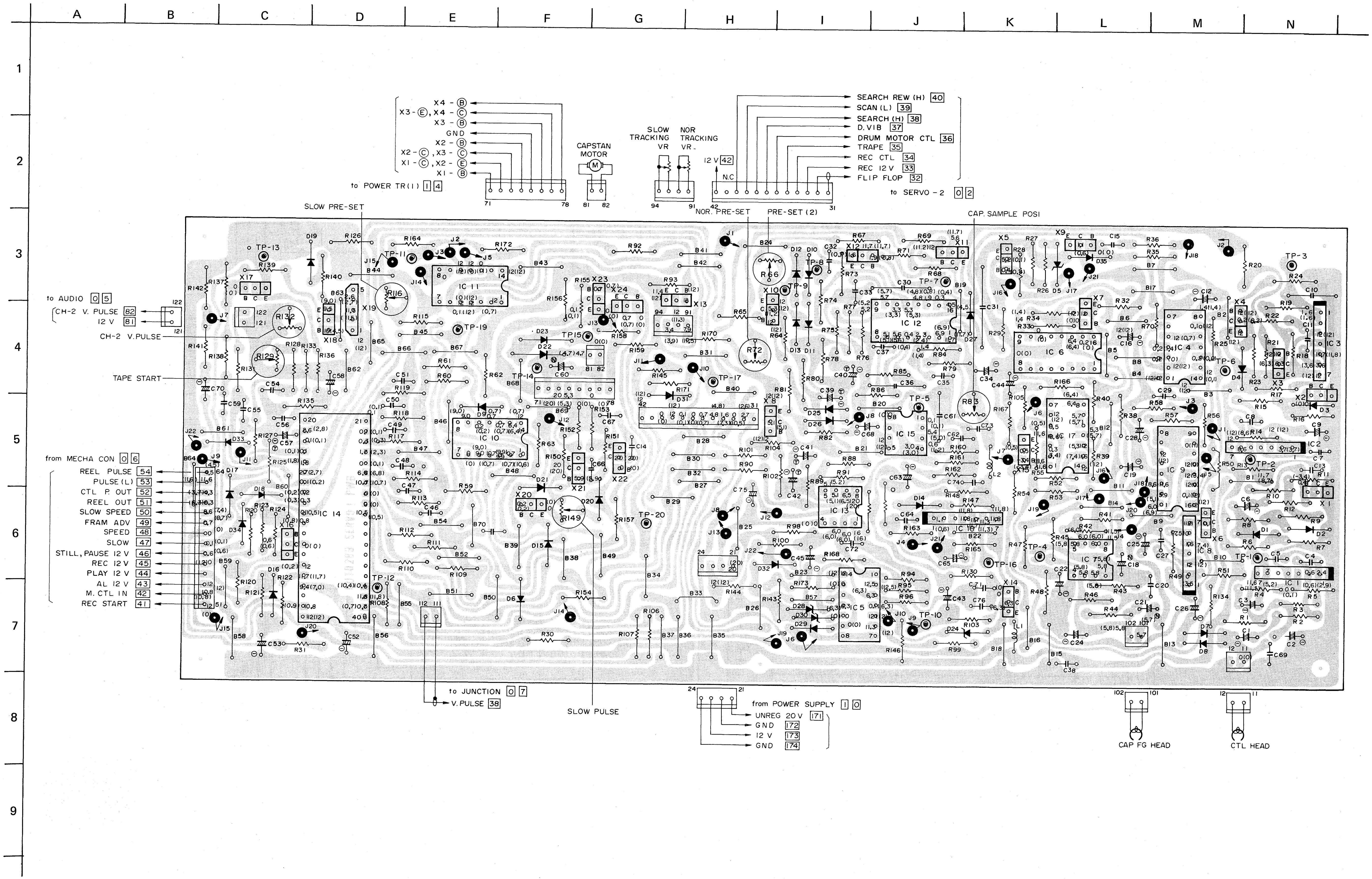
SAFETY PRECAUTION:

Shaded (▨) parts are critical for safety. Replace only with only with part number specified.

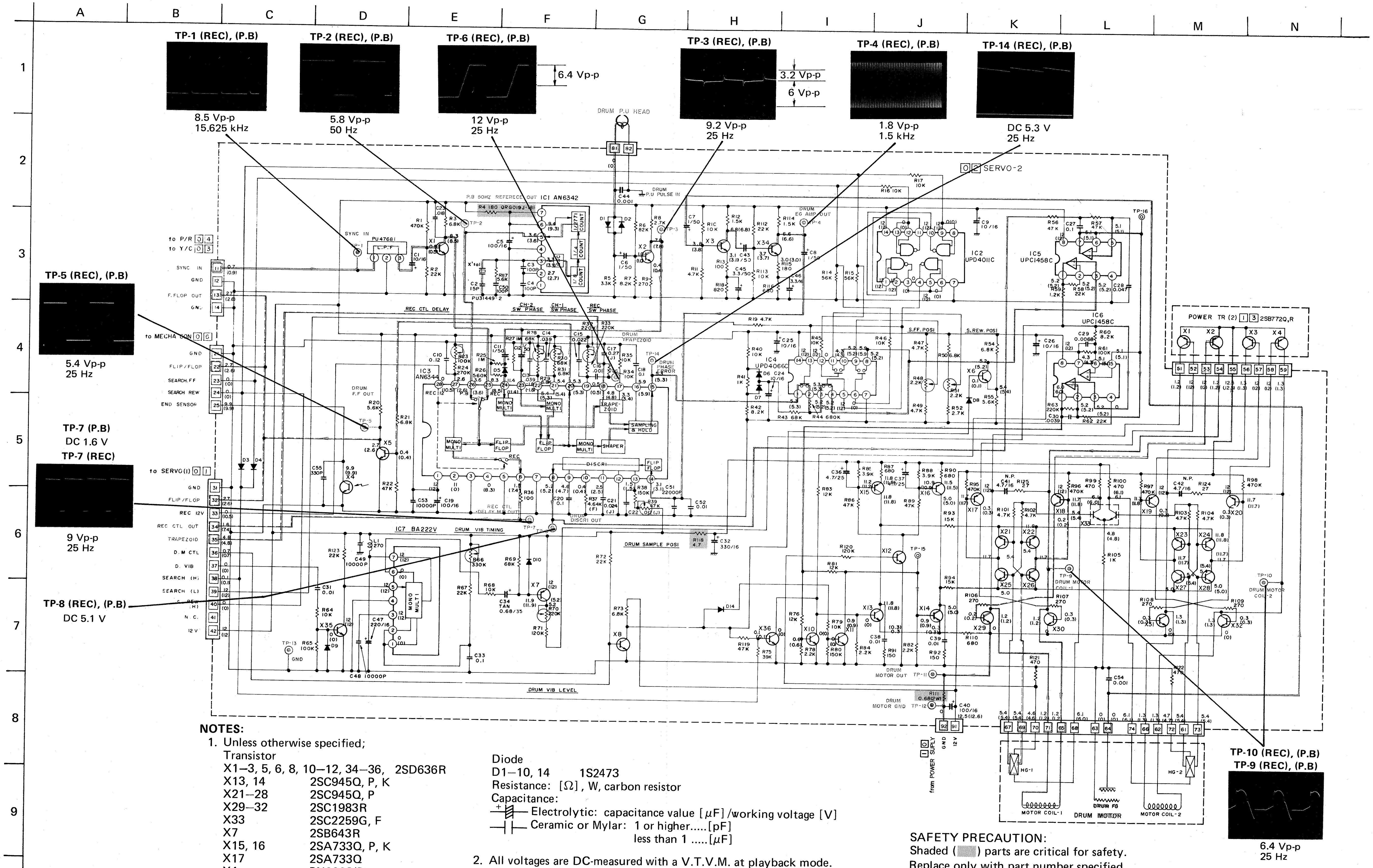


from CONNECTOR PANEL
ANT IN V/U TUNER
IF OUT
AFC
BT
BU
AGC
TUNER P.W.B
4 5
J1 J2 J3 J4 J5 J6 J7 J8
P3
NC 301
BT IN 302
NC 303
NC 304
BU IN 305
12V IN 306
GND 307
from T/T CONTROLLER
P2
MUTE IN 201
DEFEAT IN 202
OFFSET IN 203
40V IN 204
NC 205
30V OUT 206
VIDEO OUT 207
GND 208
AFC OUT 209
GND 210
NC 211
NC 212
to T/T CONTROLLER
P1
VIDEO OUT 101
GND 102
GND 103
AUDIO OUT 104
to J. BOARD
X7
X8
X9
R66 3W UFR 1K
IC3 μPC574J
TP16
HI.B
IN
OUT
IC1 AN5111
T2 39.5MHz
T3 39.5MHz
T4 6MHz
T1 33.5MHz
TP10
TP11
TP12
TP14
TP21
IC2 AN5732
T5 6MHz
T6 6MHz
CF1 6MHz
R49 1/4W FR33
TP22
AUDIO
X5
X6
TP23
TP E
X1
X2
X3
X4 2SC1213A
R48 1/4W FR22
TP13
COLOR (1)
VIDEO
COLOR (2)
1 1
IF P.W.B

8.17 SERVO-1 CIRCUIT BOARD


A B C D E F G H I J K L M N
1 2 3 4 5 6 7 8 9
X4 - Ⓑ
X3 - Ⓔ, X4 - Ⓒ
X3 - Ⓑ
GND
X2 - Ⓑ
X2 - Ⓒ, X3 - Ⓒ
X1 - Ⓒ, X2 - Ⓔ
X1 - Ⓑ
to POWER TR(1) 14
CAPSTAN MOTOR
SLOW TRACKING VR
NOR TRACKING VR.
12 V 42
N.C
SEARCH REW (H) 40
SCAN (L) 39
SEARCH (H) 38
D.VIB 37
DRUM MOTOR CTL 36
TRAPE 35
REC CTL 34
REC 12 V 33
FLIP FLOP 32
to SERVO - 2 02
SLOW PRE-SET
NOR. PRE-SET
PRE-SET (2)
CAP. SAMPLE POSI
to AUDIO 05
CH-2 V. PULSE 82
12 V 81
CH-2 V.PULSE
TAPE START
from MECHA CON 06
REEL PULSE 54
PULSE (L) 53
CTL P. OUT 52
REEL OUT 51
SLOW SPEED 50
FRAM ADV 49
SPEED 48
SLOW 47
STILL, PAUSE 12 V 46
REC 12 V 45
PLAY 12 V 44
AL 12 V 43
M. CTL IN 42
REC START 41
to JUNCTION 07
V. PULSE 38
SLOW PULSE
from POWER SUPPLY 10
UNREG 20 V 171
GND 172
12 V 173
GND 174
CAP FG HEAD
CTL HEAD
IC 1
IC 2
IC 3
IC 4
IC 5
IC 6
IC 7
IC 8
IC 9
IC 10
IC 11
IC 12
IC 13
IC 14
IC 15
IC 16
TP-1
TP-2
TP-3
TP-4
TP-5
TP-6
TP-7
TP-8
TP-9
TP-10
TP-11
TP-12
TP-13
TP-14
TP-15
TP-16
TP-17
TP-19
TP-20
R66
R72
R83
R116
R129
R132
R149

8.18 SERVO-2 CIRCUIT SCHEMATIC DIAGRAM


A B C D E F G H I J K L M N
1 2 3 4 5 6 7 8 9
TP-1 (REC), (P.B)
8.5 Vp-p
15.625 kHz
TP-2 (REC), (P.B)
5.8 Vp-p
50 Hz
TP-6 (REC), (P.B)
6.4 Vp-p
12 Vp-p
25 Hz
TP-3 (REC), (P.B)
3.2 Vp-p
6 Vp-p
9.2 Vp-p
25 Hz
TP-4 (REC), (P.B)
1.8 Vp-p
1.5 kHz
TP-14 (REC), (P.B)
DC 5.3 V
25 Hz
TP-5 (REC), (P.B)
5.4 Vp-p
25 Hz
TP-7 (P.B)
DC 1.6 V
TP-7 (REC)
9 Vp-p
25 Hz
TP-8 (REC), (P.B)
DC 5.1 V
TP-10 (REC), (P.B)
TP-9 (REC), (P.B)
6.4 Vp-p
25 Hz
DRUM P.U HEAD
SERVO-2
IC1 AN6342
IC2 UPD4011C
IC3 AN6344
IC4 UPD4066C
IC5 UPC1458C
IC6 UPC1458C
IC7 BA222V
POWER TR (2) 2SB772Q,R
REC CTL DELAY
CH-2 SW PHASE
CH-1 SW PHASE
REC SW PHASE
DRUM TRAPEZOID
DRUM PHASE ERROR
SAMPLING & HOLD
DISCRI
DRUM DISCRI OUT
DRUM SAMPLE POSI
DRUM V16 TIMING
DRUM V16 LEVEL
S.FF. POSI
S.REW. POSI
DRUM MOTOR OUT
DRUM MOTOR GND
DRUM MOTOR COIL-1
DRUM MOTOR COIL-2
MOTOR COIL-1
MOTOR COIL-2
DRUM MOTOR
DRUM FG
HG-1
HG-2
from POWER SUPPLY
GND
12V
to P/R
to Y/C
to MECHA CON
to SERVO(1)
SYNC IN
F.FLOP OUT
FLIP/FLOP
SEARCH. F.F
SEARCH REW
END SENSOR
REC 12V
REC CTL OUT
TRAPEZOID
D.M CTL
D. V16
SEARCH (H)
SEARCH (L)
N.C.
MONO MULTI
FLIP FLOP
SHAPER
L.P.F
PU4768I
PU31449-2

NOTES:

1. Unless otherwise specified;

Transistor

X1–3, 5, 6, 8, 10–12, 34–36,	2SD636R
X13, 14	2SC945Q, P, K
X21–28	2SC945Q, P
X29–32	2SC1983R
X33	2SC2259G, F
X7	2SB643R
X15, 16	2SA733Q, P, K
X17	2SA733Q
X4	PN202S(Photo Transistor)

Diode

D1–10, 14	1S2473

Resistance: [Ω], W, carbon resistor

Capacitance:

Electrolytic: capacitance value [μF]/working voltage [V]

Ceramic or Mylar: 1 or higher.....[pF]

less than 1 .....[μF]

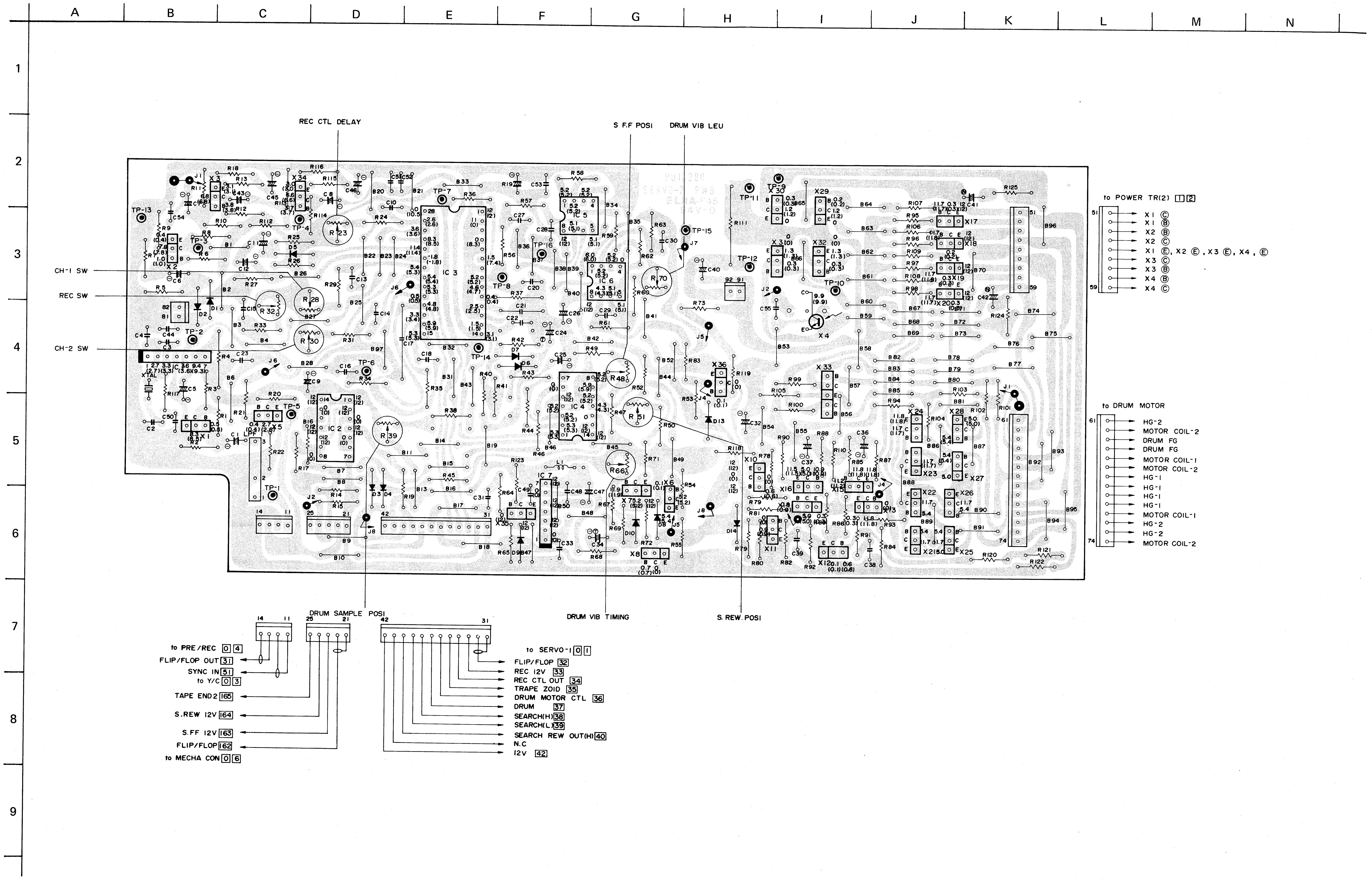
2. All voltages are DC-measured with a V.T.V.M. at playback mode.
( ) represents the DC voltage at record mode.

SAFETY PRECAUTION:

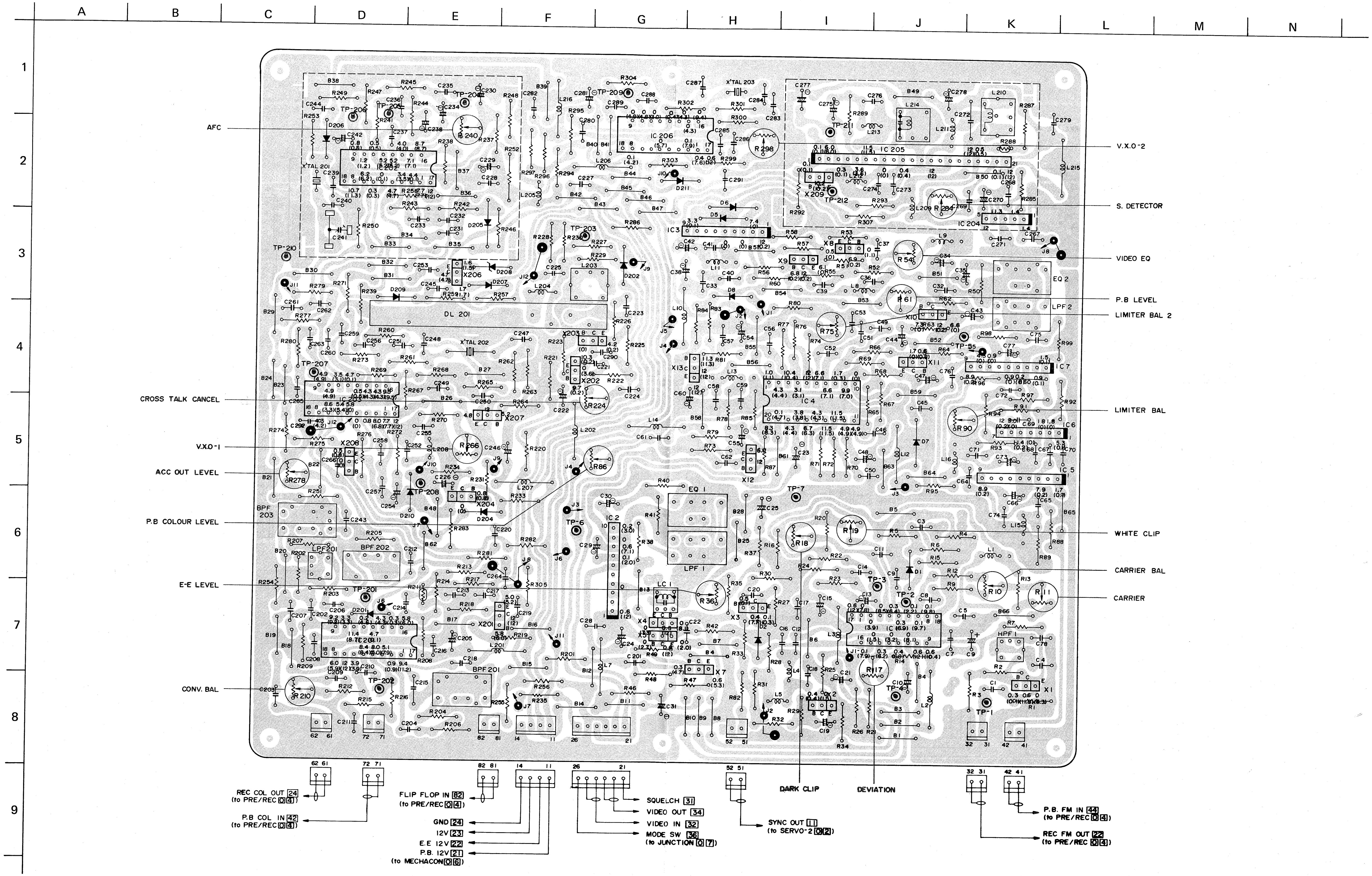
Shaded (▨) parts are critical for safety.

Replace only with part number specified.

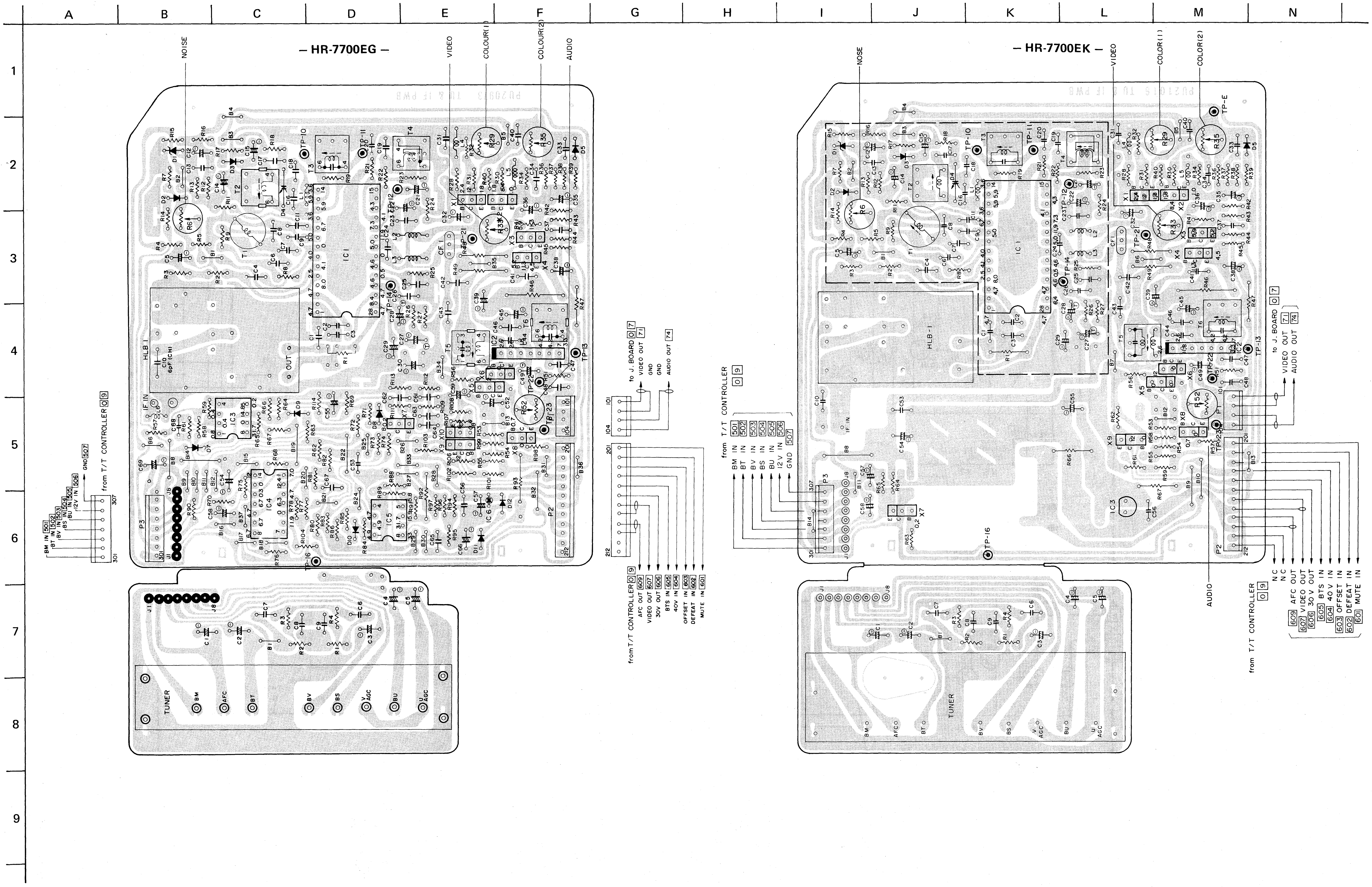
8.19 SERVO-2 CIRCUIT BOARD


A
B
C
D
E
F
G
H
I
J
K
L
M
N
1
2
3
4
5
6
7
8
9
REC CTL DELAY
S F.F POSI
DRUM VIB LEU
CH-1 SW
REC SW
CH-2 SW
IC 2
IC 3
IC 4
IC 5
IC 6
IC 7
R 23
R 28
R 30
R 32
R 39
R 48
R 51
R 66
R 70
X'TAL
TP-1
TP-2
TP-3
TP-4
TP-5
TP-6
TP-7
TP-8
TP-9
TP-10
TP-11
TP-12
TP-13
TP-14
TP-15
TP-16
DRUM SAMPLE POSI
DRUM VIB TIMING
S. REW. POSI
14
11
25
21
42
31
to PRE/REC 0 4
FLIP/FLOP OUT 31
SYNC IN 51
to Y/C 0 3
TAPE END2 165
S.REW 12V 164
S.FF 12V 163
FLIP/FLOP 162
to MECHA CON 0 6
to SERVO-1 0 1
FLIP/FLOP 32
REC 12V 33
REC CTL OUT 34
TRAPE ZOID 35
DRUM MOTOR CTL 36
DRUM 37
SEARCH(H) 38
SEARCH(L) 39
SEARCH REW OUT(H) 40
N.C
12V 42
to POWER TR(2) 1 2
51
59
X1 Ⓒ
X1 Ⓑ
X2 Ⓑ
X2 Ⓒ
X1 Ⓔ, X2 Ⓔ, X3 Ⓔ, X4, Ⓔ
X3 Ⓒ
X3 Ⓑ
X4 Ⓑ
X4 Ⓒ
to DRUM MOTOR
61
74
HG-2
MOTOR COIL-2
DRUM FG
DRUM FG
MOTOR COIL-1
MOTOR COIL-2
HG-1
HG-1
HG-1
HG-1
MOTOR COIL-1
HG-2
HG-2
MOTOR COIL-2

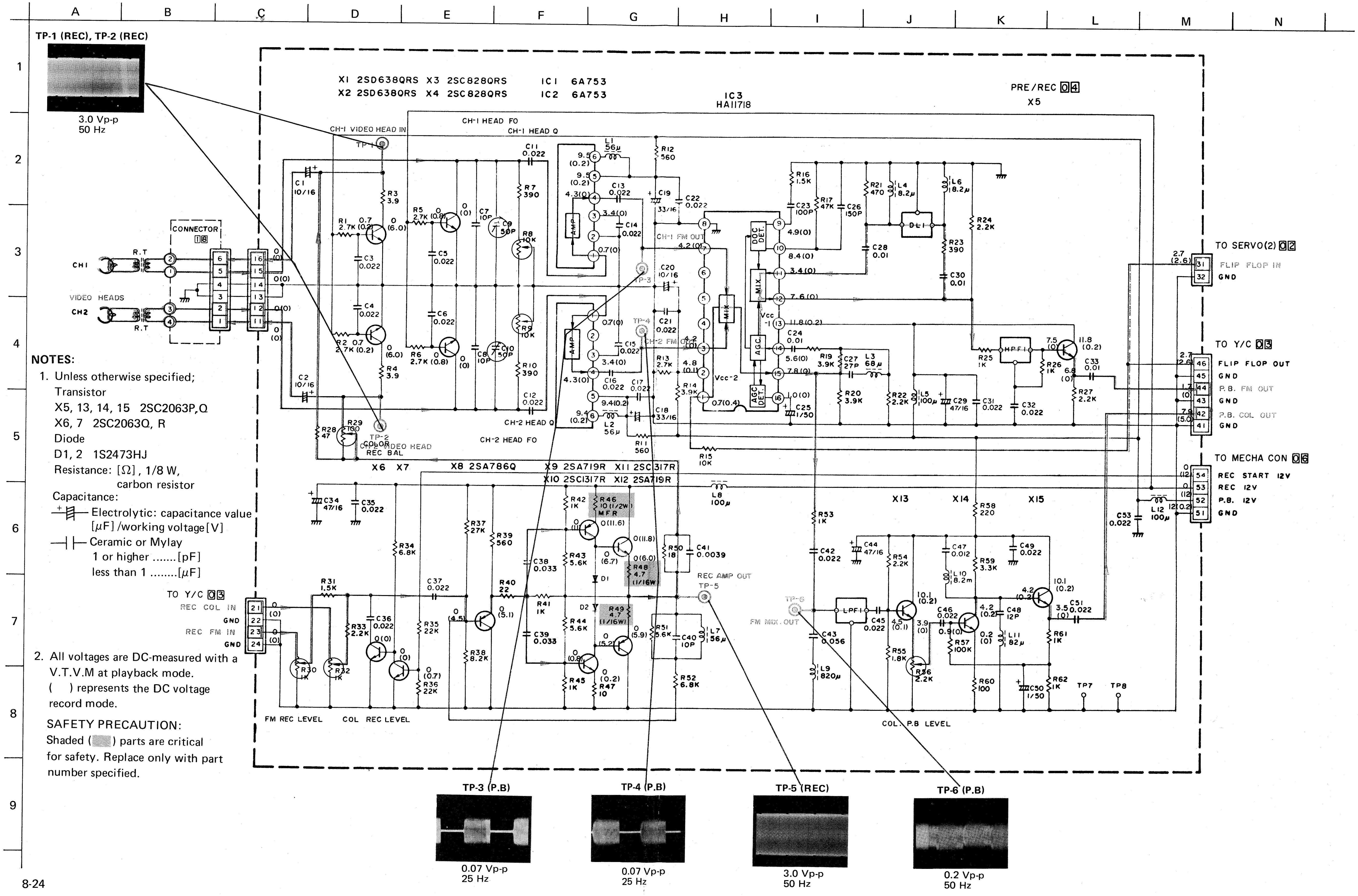
8.20 LUMINANCE AND CHROMINANCE (Y/C) CIRCUIT BOARD


A
B
C
D
E
F
G
H
I
J
K
L
M
N
1
2
3
4
5
6
7
8
9
AFC
V.X.O-2
S. DETECTOR
VIDEO EQ
P.B LEVEL
LIMITER BAL 2
CROSS TALK CANCEL
LIMITER BAL
V.X.O-1
ACC OUT LEVEL
P.B COLOUR LEVEL
WHITE CLIP
CARRIER BAL
E-E LEVEL
CARRIER
CONV. BAL
DARK CLIP
DEVIATION
REC COL OUT 24 (to PRE/REC 04)
P.B COL IN 42 (to PRE/REC 04)
FLIP FLOP IN 82 (to PRE/REC 04)
GND 24
12V 23
E.E 12V 22
P.B. 12V 21 (to MECHACON 06)
SQUELCH 31
VIDEO OUT 34
VIDEO IN 32
MODE SW 36 (to JUNCTION 07)
SYNC OUT 11 (to SERVO-2 02)
P.B. FM IN 44 (to PRE/REC 04)
REC FM OUT 22 (to PRE/REC 04)

8.23 TUNER CIRCUIT BOARD


A
B
C
D
E
F
G
H
I
J
K
L
M
N
1
2
3
4
5
6
7
8
9
– HR-7700EG –
NOISE
VIDEO
COLOUR(1)
COLOUR(2)
AUDIO
IC1
IC3
IC4
IC5
IC6
HLB I
IF IN
OUT
TP-10
TP-11
TP-12
TP-13
TP-14
TP-16
TP-21
TP-22
TP-23
TUNER
BM
AFC
BT
BV
BS
V AGC
BU
U AGC
P2
P3
J1
J8
from T/T CONTROLLER 0 9
BM IN 501
BT IN 502
BV IN 503
BS IN 504
BU IN 505
12V IN 506
GND 507
301
307
to J. BOARD 0 7
VIDEO OUT 71
GND
GND
AUDIO OUT 74
101
104
201
212
from T/T CONTROLLER 0 9
AFC OUT 609
VIDEO OUT 607
30V OUT 606
BTS IN 605
40V IN 604
OFFSET IN 603
DEFEAT IN 602
MUTE IN 601
from T/T CONTROLLER 0 9
from BM IN 501
BT IN 502
BV IN 503
BS IN 504
BU IN 505
12V IN 506
GND 507
– HR-7700EK –
NOSE
VIDEO
COLOR(1)
COLOR(2)
TP-E
AUDIO
IC1
IC2
IC3
HLB-1
IF IN
TUNER
to J. BOARD 0 7
VIDEO OUT 71
AUDIO OUT 74
from T/T CONTROLLER 0 9
N C
N C
609 AFC OUT
607 VIDEO OUT
606 30 V OUT
605 BTS IN
604 40 V IN
603 OFFSET IN
602 DEFEAT IN
601 MUTE IN

8.24 PRE AND RECORD (PRE/REC) CIRCUIT SCHEMATIC DIAGRAM

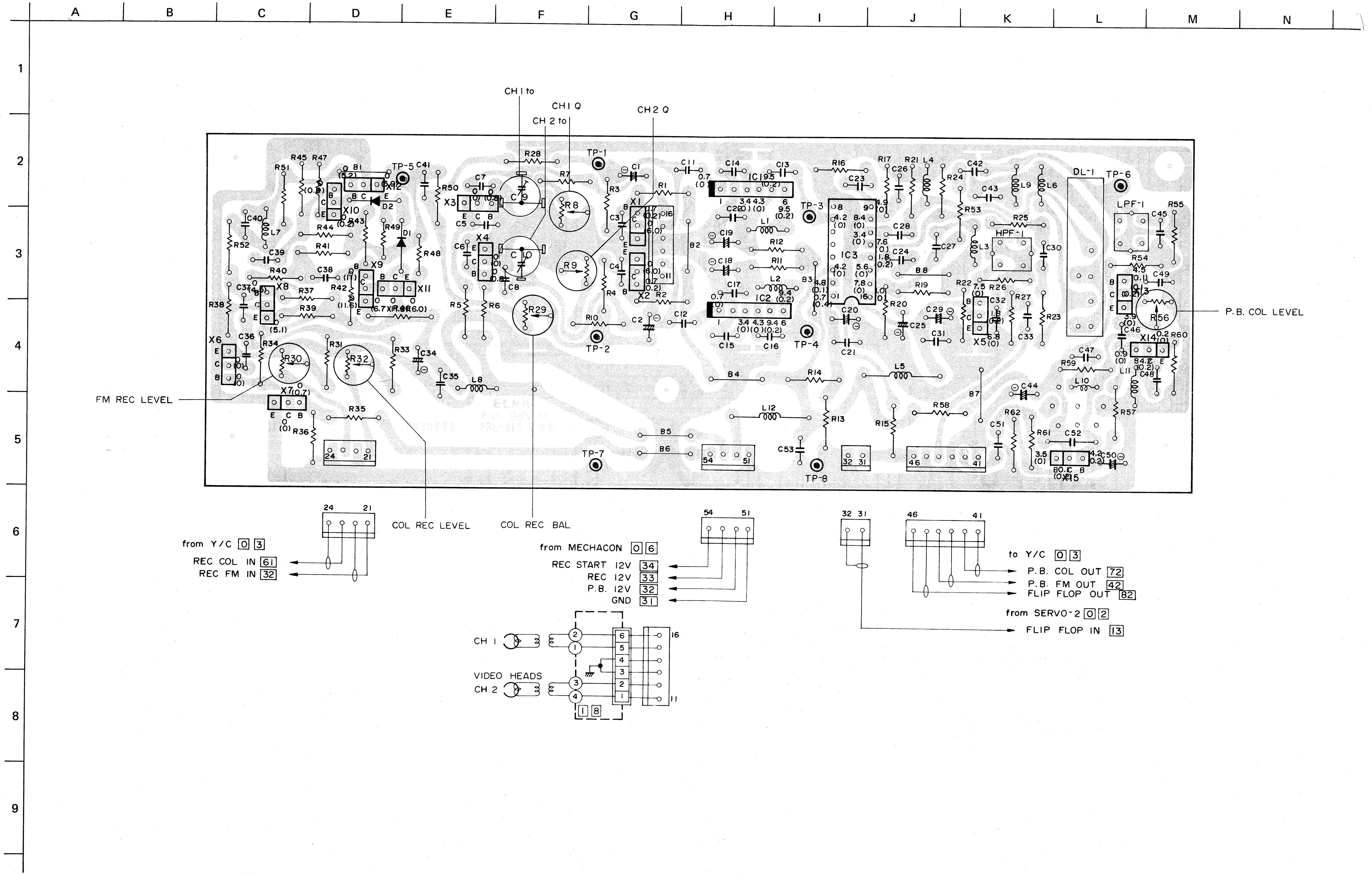

A
B
C
D
E
F
G
H
I
J
K
L
M
N
1
2
3
4
5
6
7
8
9
TP-1 (REC), TP-2 (REC)
3.0 Vp-p
50 Hz
X1 2SD638QRS X3 2SC828QRS
X2 2SD638QRS X4 2SC828QRS
IC1 6A753
IC2 6A753
IC3
HA11718
PRE/REC 04
X5
CH-1 VIDEO HEAD IN
CH-1 HEAD FO
CH-1 HEAD Q
TP-1
CONNECTOR 18
R.T
CH1
VIDEO HEADS
CH2
AMP
MIX
AGC
DOC DET.
AGC DET.
DL1
HPF1
LPF1
CH-1 FM OUT
CH-2 FM OUT
TP-3
TP-4
Vcc-2
Vcc-1
CH-2 HEAD Q
CH-2 HEAD FO
TP-2
COLOR REC BAL
CH-2 VIDEO HEAD
X6 X7
X8 2SA786Q
X9 2SA719R X11 2SC317R
X10 2SC1317R X12 2SA719R
X13
X14
X15
R46 10 (1/2W) MFR
R48 4.7 (1/16W)
R49 4.7 (1/16W)
D1
D2
REC AMP OUT
TP-5
TP-6
FM MIX. OUT
TO SERVO(2) 02
FLIP FLOP IN
GND
TO Y/C 03
FLIP FLOP OUT
GND
P.B. FM OUT
GND
P.B. COL OUT
GND
TO MECHA CON 06
REC START 12V
REC 12V
P.B. 12V
GND
TO Y/C 03
REC COL IN
GND
REC FM IN
GND
FM REC LEVEL
COL REC LEVEL
COL. P.B LEVEL
TP7
TP8
TP-3 (P.B)
0.07 Vp-p
25 Hz
TP-4 (P.B)
0.07 Vp-p
25 Hz
TP-5 (REC)
3.0 Vp-p
50 Hz
TP-6 (P.B)
0.2 Vp-p
50 Hz

NOTES:

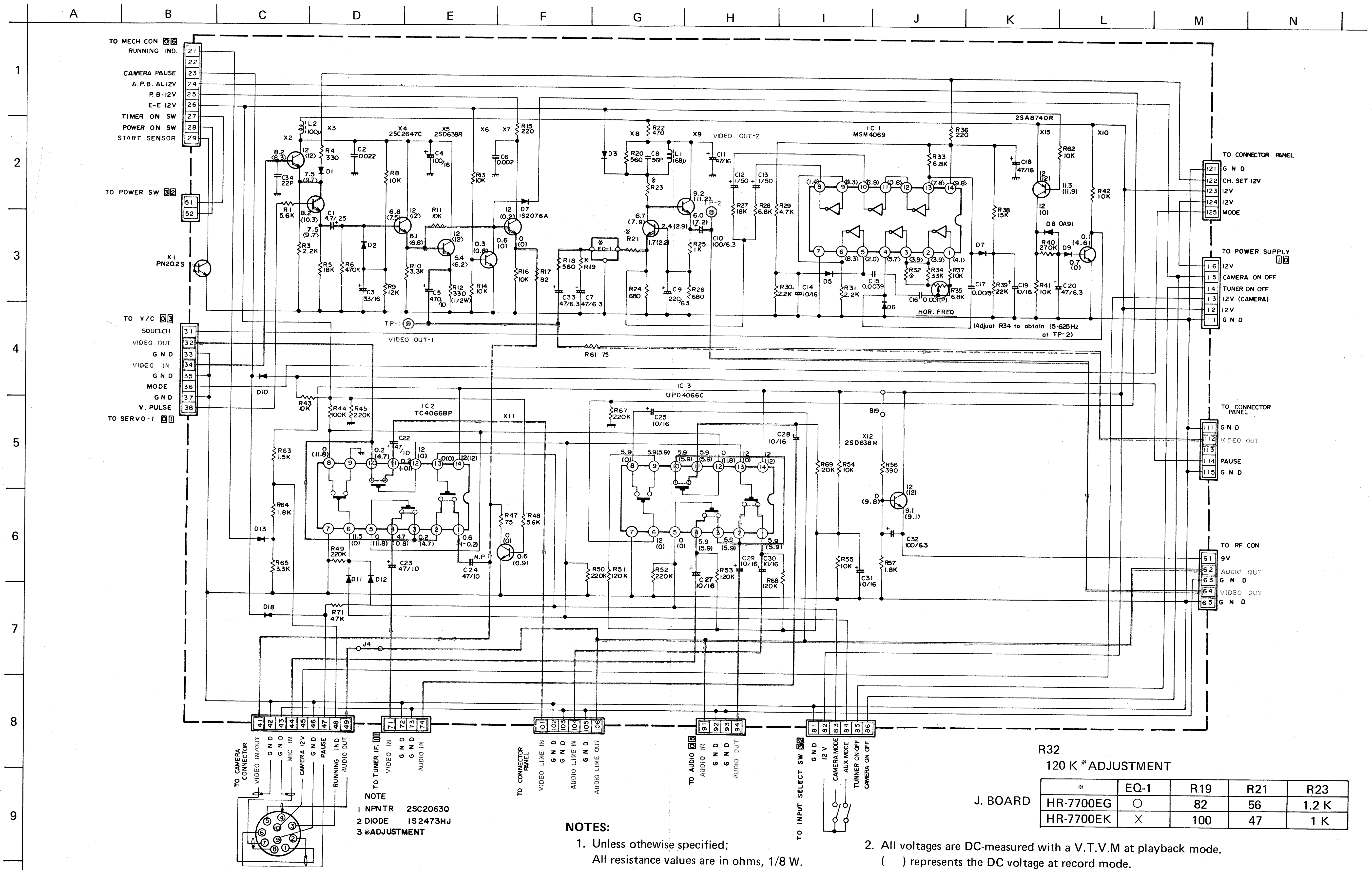
1. Unless otherwise specified;
   Transistor
   X5, 13, 14, 15 2SC2063P,Q
   X6, 7 2SC2063Q, R
   Diode
   D1, 2 1S2473HJ
   Resistance: [Ω], 1/8 W, carbon resistor
   Capacitance:
   Electrolytic: capacitance value [μF]/working voltage[V]
   Ceramic or Mylay
   1 or higher ....[pF]
   less than 1 ....[μF]
2. All voltages are DC-measured with a V.T.V.M at playback mode.
   ( ) represents the DC voltage record mode.

SAFETY PRECAUTION:
Shaded (▨) parts are critical for safety. Replace only with part number specified.

8.25 PRE AND RECORD (PRE/REC) CIRCUIT BOARD


A
B
C
D
E
F
G
H
I
J
K
L
M
N
1
2
3
4
5
6
7
8
9
CH 1 to
CH 1 Q
CH 2 to
CH 2 Q
TP-1
TP-2
TP-3
TP-4
TP-5
TP-6
TP-7
TP-8
IC1
IC2
IC3
DL-1
LPF-1
HPF-1
FM REC LEVEL
COL REC LEVEL
COL REC BAL
P.B. COL LEVEL
24 21
54 51
32 31
46 41
from Y/C 03
REC COL IN 61
REC FM IN 32
from MECHACON 06
REC START 12V 34
REC 12V 33
P.B. 12V 32
GND 31
to Y/C 03
P.B. COL OUT 72
P.B. FM OUT 42
FLIP FLOP OUT 82
from SERVO-2 02
FLIP FLOP IN 13
CH 1
VIDEO HEADS
CH 2
16
11
18

8.26 JUNCTION CIRCUIT SCHEMATIC DIAGRAM


TO MECH CON 06
RUNNING IND.
CAMERA PAUSE
A.P.B. AL12V
P.B-12V
E-E 12V
TIMER ON SW
POWER ON SW
START SENSOR
TO POWER SW 32
PN2025
TO Y/C 03
SQUELCH
VIDEO OUT
GND
VIDEO IN
MODE
V. PULSE
TO SERVO-1 01
X2
X3
X4 2SC2647C
X5 2SD638R
X6
X7
X8
X9
VIDEO OUT-2
IC1 MSM4069
2SA874QR
X10
X15
TP-1
VIDEO OUT-1
TP-2
EQ-1
HOR. FREQ
(Adjust R34 to obtain 15.625Hz at TP-2)
R61 75
IC3 UPD4066C
IC2 TC4066BP
X11
X12 2SD638R
J4
TO CONNECTOR PANEL
GND
CH. SET 12V
12V
MODE
TO POWER SUPPLY 10
CAMERA ON OFF
TUNER ON OFF
12V (CAMERA)
TO CONNECTOR PANEL
VIDEO OUT
PAUSE
TO RF CON
9V
AUDIO OUT
TO CAMERA CONNECTOR
VIDEO IN/OUT
MIC IN
CAMERA 12V
PAUSE
RUNNING IND
AUDIO OUT
TO TUNER IF. 11
VIDEO IN
AUDIO IN
TO CONNECTOR PANEL
VIDEO LINE IN
AUDIO LINE IN
AUDIO LINE OUT
TO AUDIO 05
AUDIO IN
AUDIO OUT
TO INPUT SELECT SW 12
CAMERA MODE
AUX MODE
TUNNER ON-OFF
CAMERA ON OFF

NOTE
1 NPNTR 2SC2063Q
2 DIODE 1S2473HJ
3 ※ADJUSTMENT

R32
120 K ※ADJUSTMENT

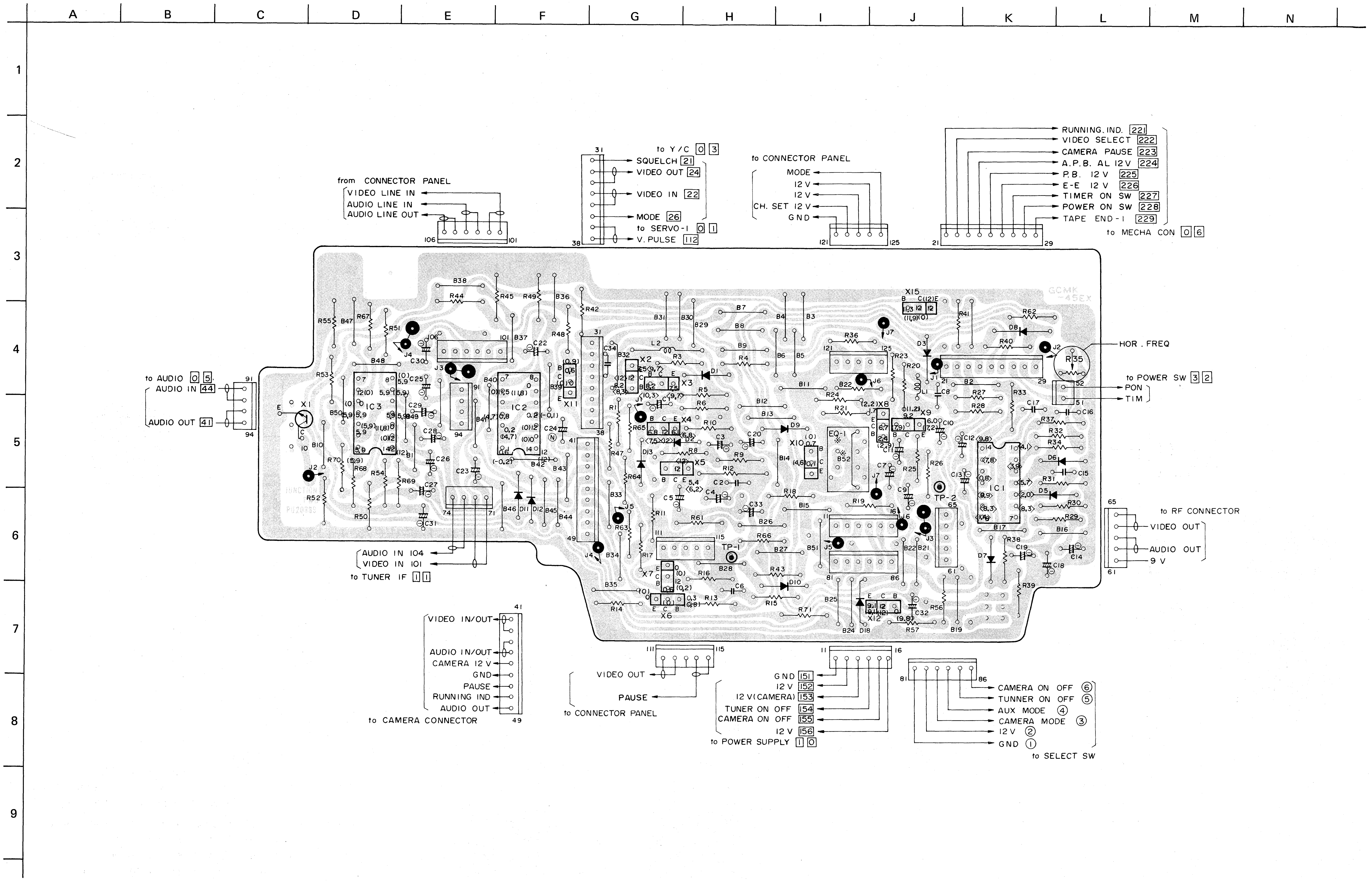
J. BOARD

※	EQ-1	R19	R21	R23
HR-7700EG	○	82	56	1.2 K
HR-7700EK	X	100	47	1 K

NOTES:

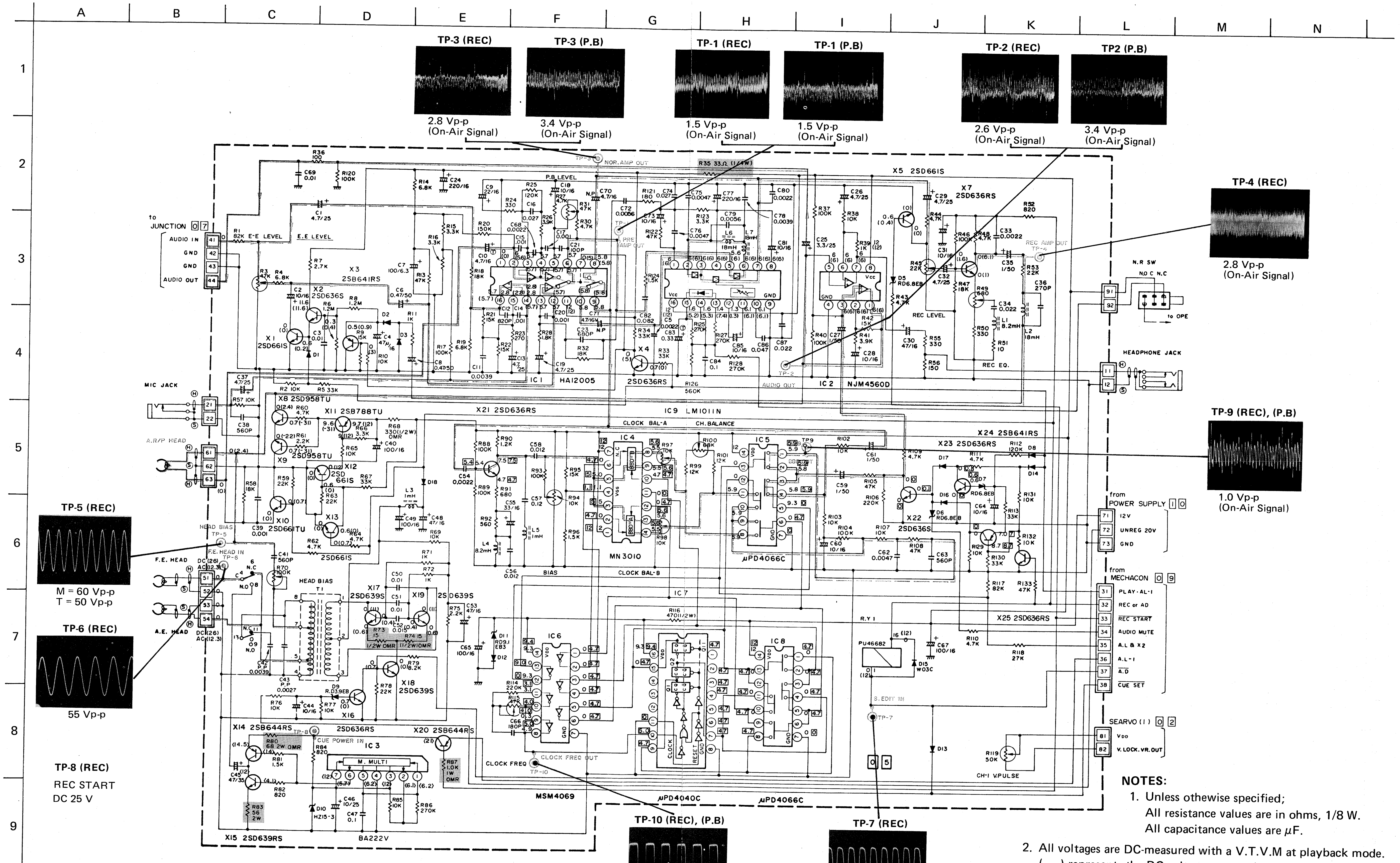
1. Unless othewise specified;
   All resistance values are in ohms, 1/8 W.
   All capacitance values are μF.
2. All voltages are DC-measured with a V.T.V.M at playback mode.
   ( ) represents the DC voltage at record mode.
   < > represents the DC voltage at CH set mode.

8.27 JUNCTION CIRCUIT BOARD



A
B
C
D
E
F
G
H
I
J
K
L
M
N
1
2
3
4
5
6
7
8
9
from CONNECTOR PANEL
VIDEO LINE IN
AUDIO LINE IN
AUDIO LINE OUT
106
101
to Y/C 03
SQUELCH 21
VIDEO OUT 24
VIDEO IN 22
MODE 26
to SERVO-1 01
V. PULSE 112
31
38
to CONNECTOR PANEL
MODE
12 V
12 V
CH. SET 12 V
GND
121
125
RUNNING. IND. 221
VIDEO SELECT 222
CAMERA PAUSE 223
A.P.B. AL 12 V 224
P.B. 12 V 225
E-E 12 V 226
TIMER ON SW 227
POWER ON SW 228
TAPE END-1 229
to MECHA CON 06
21
29
HOR. FREQ
to POWER SW 32
PON
TIM
51
52
to AUDIO 05
AUDIO IN 44
AUDIO OUT 41
91
94
to RF CONNECTOR
VIDEO OUT
AUDIO OUT
9 V
65
61
AUDIO IN 104
VIDEO IN 101
to TUNER IF 11
VIDEO IN/OUT
AUDIO IN/OUT
CAMERA 12 V
GND
PAUSE
RUNNING IND
AUDIO OUT
to CAMERA CONNECTOR
41
49
VIDEO OUT
PAUSE
to CONNECTOR PANEL
111
115
GND 151
12 V 152
12 V(CAMERA) 153
TUNER ON OFF 154
CAMERA ON OFF 155
12 V 156
to POWER SUPPLY 10
11
16
CAMERA ON OFF ⑥
TUNNER ON OFF ⑤
AUX MODE ④
CAMERA MODE ③
12 V ②
GND ①
to SELECT SW
81
86
IC1
IC2
IC3
X1
X2
X3
X4
X5
X6
X7
X8
X9
X10
X11
X12
X15
TP-1
TP-2
EQ-1
R35
J1
J2
J3
J4
J5
J6
J7
L1
L2
GCMK-452X
PW20885

AUDIO CIRCUIT SHCEMATIC DIAGRAM

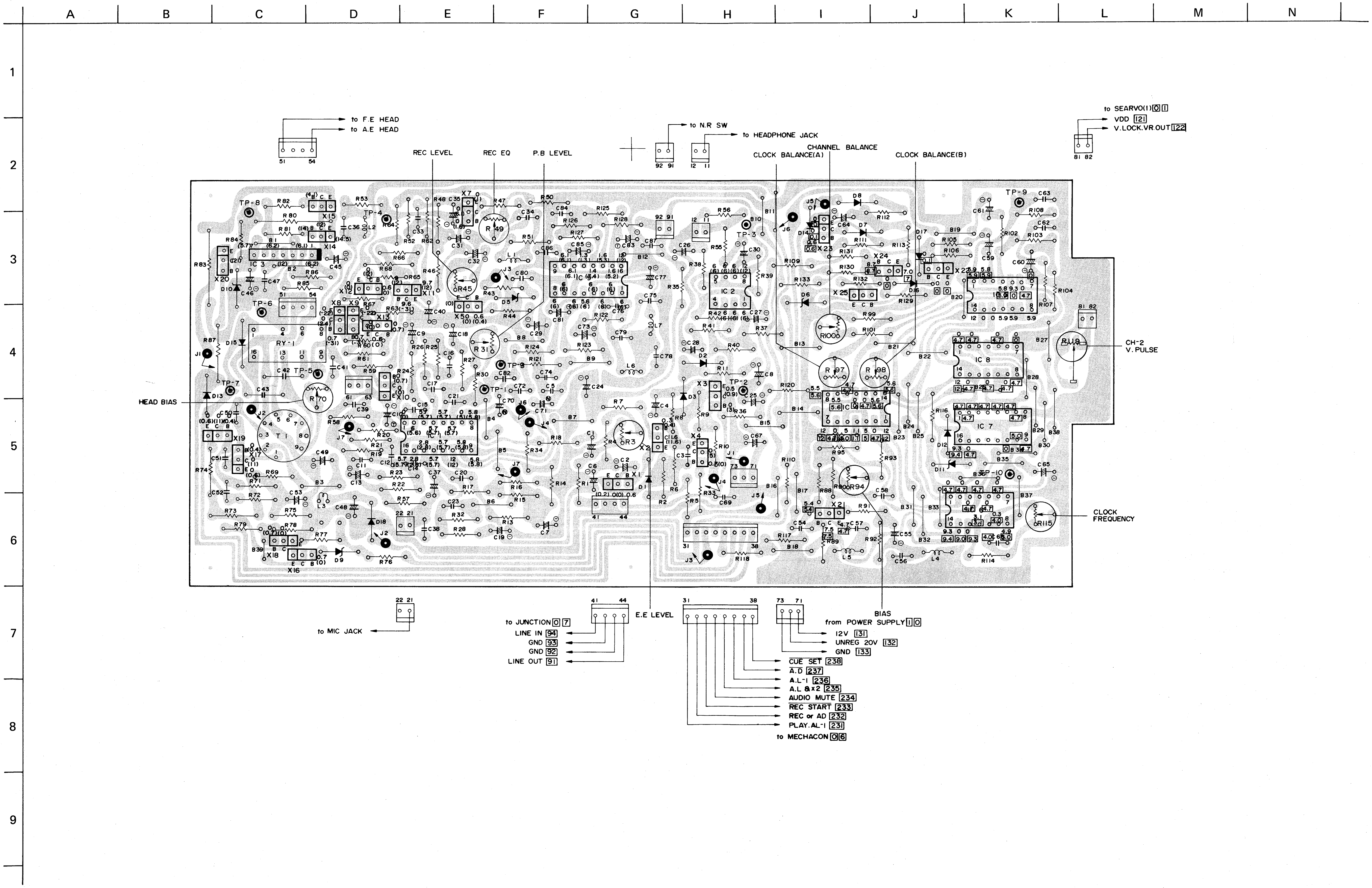

A
B
C
D
E
F
G
H
I
J
K
L
M
N
1
2
3
4
5
6
7
8
9
TP-3 (REC)
2.8 Vp-p (On-Air Signal)
TP-3 (P.B)
3.4 Vp-p (On-Air Signal)
TP-1 (REC)
1.5 Vp-p (On-Air Signal)
TP-1 (P.B)
1.5 Vp-p (On-Air Signal)
TP-2 (REC)
2.6 Vp-p (On-Air Signal)
TP2 (P.B)
3.4 Vp-p (On-Air Signal)
TP-4 (REC)
2.8 Vp-p (On-Air Signal)
TP-9 (REC), (P.B)
1.0 Vp-p (On-Air Signal)
TP-5 (REC)
M = 60 Vp-p
T = 50 Vp-p
TP-6 (REC)
55 Vp-p
TP-8 (REC)
REC START
DC 25 V
TP-10 (REC), (P.B)
9.5 Vp-p
TP-7 (REC)
1.3 Vp-p
to JUNCTION 07
AUDIO IN
GND
GND
AUDIO OUT
MIC JACK
A.R/P HEAD
F.E. HEAD
A.E. HEAD
HEAD BIAS
E-E LEVEL
P.B LEVEL
NOR. AMP OUT
R35 33Ω (1/4W)
PRE AMP OUT
REC AMP OUT
AUDIO OUT
REC LEVEL
REC EQ.
IC 1 HA12005
IC 2 NJM4560D
IC 4 MN3010
IC 5 μPD4066C
IC 6
IC 7
IC 8
IC 3 BA222V
IC9 LM1011N
CLOCK BAL-A
CH. BALANCE
CLOCK BAL-B
BIAS
CLOCK FREQ
CLOCK FREQ OUT
CUE POWER IN
M. MULTI
MSM4069
μPD4040C
μPD4066C
N.R SW
to OPE
HEADPHONE JACK
from POWER SUPPLY 10
12V
UNREG 20V
GND
from MECHACON 09
PLAY-AL-I
REC or AD
REC START
AUDIO MUTE
A.L & X2
A.L-I
A.D
CUE SET
SEARVO (I) 02
VDD
V.LOCK.VR.OUT
S. EDIT IN
CH-I V.PULSE
RY 1
PU46682
05
X1 2SD661S
X2 2SD636S
X3 2SB641RS
X4 2SD636RS
X5 2SD661S
X7 2SD636RS
X8 2SD958TU
X9 2SD958TU
X10 2SD661TU
X11 2SB788TU
X12 2SD661S
X13 2SD661S
X14 2SB644RS
X15 2SD639RS
X16 2SD636RS
X17 2SD639S
X18 2SD639S
X19 2SD639S
X20 2SB644RS
X21 2SD636RS
X22 2SD636S
X23 2SD636RS
X24 2SB641RS
X25 2SD636RS

SAFETY PRECAUTION:
Shaded (▨) parts are critical for safety. Replace only with part number specified.

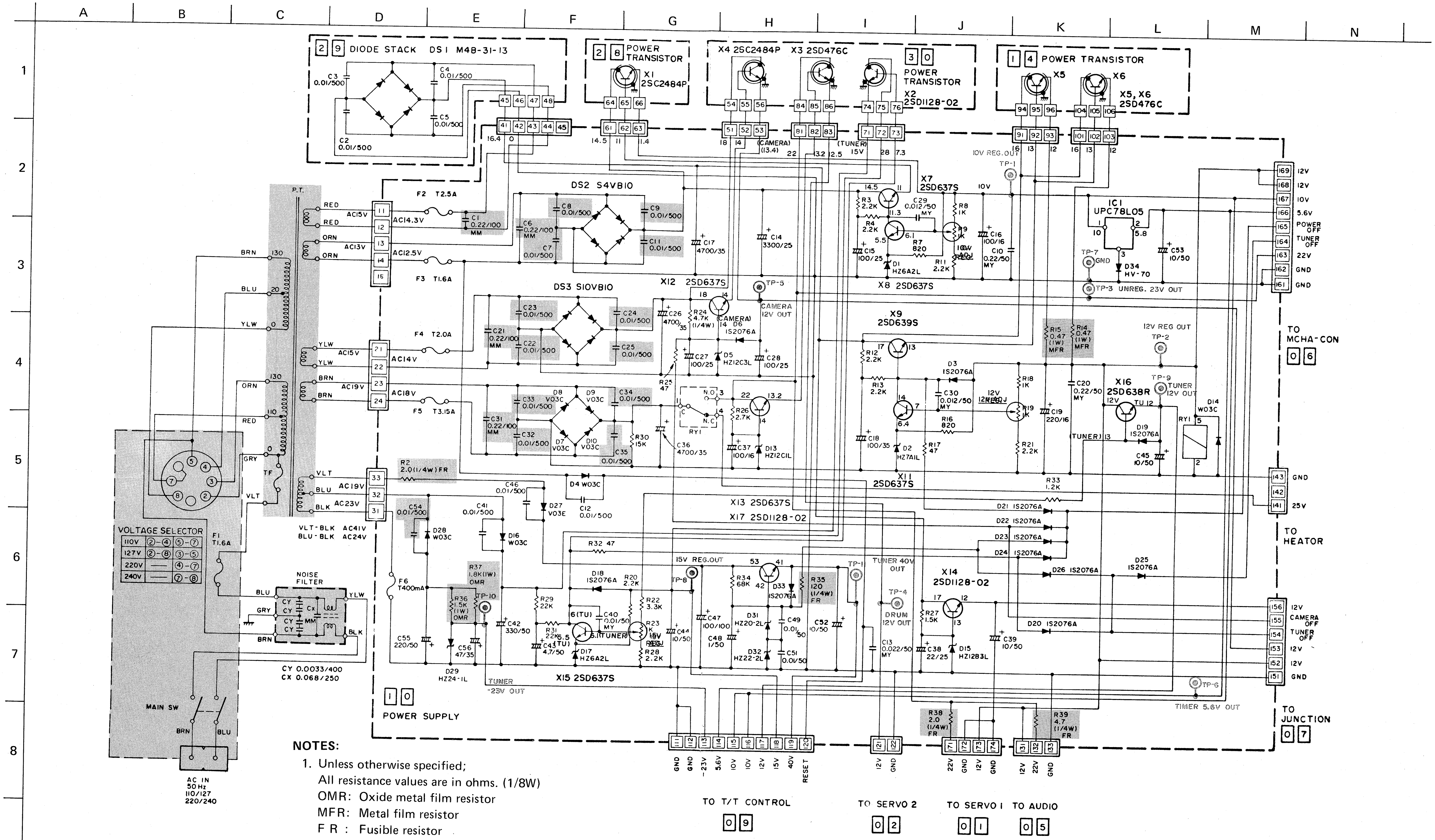
NOTES:

1. Unless othewise specified;
   All resistance values are in ohms, 1/8 W.
   All capacitance values are μF.
2. All voltages are DC-measured with a V.T.V.M at playback mode.
   ( ) represents the DC voltage at record mode.
   [ ]-represents the DC voltage at X2 mode.
   < > represents the DC voltage at record start mode.

8.29 AUDIO CIRCUIT BOARD


A
B
C
D
E
F
G
H
I
J
K
L
M
N
1
2
3
4
5
6
7
8
9
to F.E HEAD
to A.E HEAD
51 54
REC LEVEL
REC EQ
P.B LEVEL
to N.R SW
to HEADPHONE JACK
92 91
12 11
CHANNEL BALANCE
CLOCK BALANCE(A)
CLOCK BALANCE(B)
to SEARVO(1) 01
VDD 121
V.LOCK.VR.OUT 122
81 82
HEAD BIAS
CH-2 V.PULSE
CLOCK FREQUENCY
22 21
to MIC JACK
41 44
to JUNCTION 07
LINE IN 94
GND 93
GND 92
LINE OUT 91
E.E LEVEL
31 38
CUE SET 238
A.D 237
A.L-1 236
A.L &x2 235
AUDIO MUTE 234
REC START 233
REC or AD 232
PLAY.AL-1 231
to MECHACON 06
73 71
BIAS
from POWER SUPPLY 10
12V 131
UNREG 20V 132
GND 133

8.30 POWER SUPPLY CIRCUIT SCHEMATIC DIAGARM

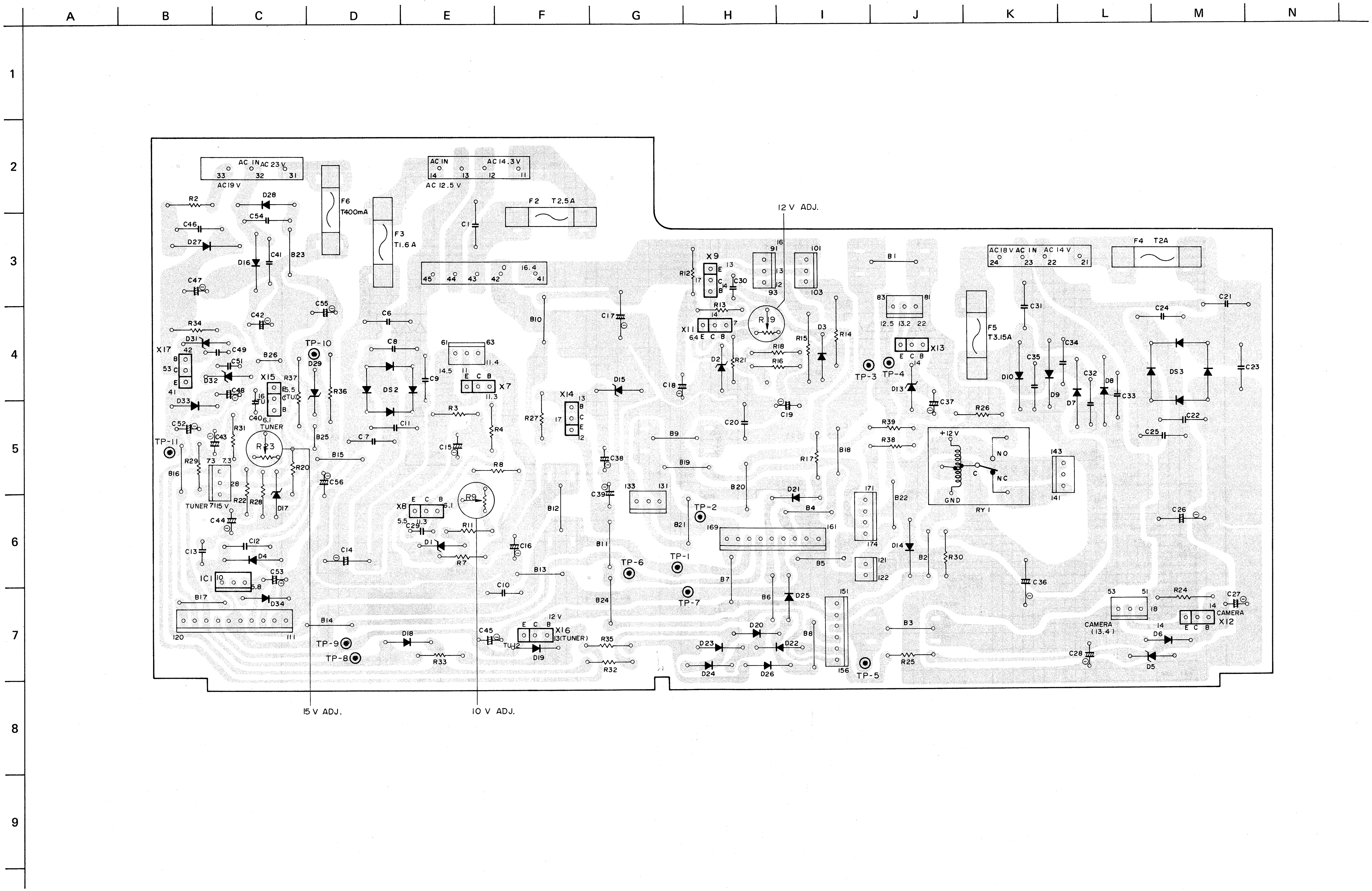

A B C D E F G H I J K L M N
1 2 3 4 5 6 7 8 9
29 DIODE STACK DS1 M48-31-13
28 POWER TRANSISTOR X1 2SC2484P
X4 2SC2484P X3 2SD476C
30 POWER TRANSISTOR X2 2SD1128-02
14 POWER TRANSISTOR X5 X6
X5, X6 2SD476C
DS2 S4VB10
DS3 S10VB10
P.T.
F2 T2.5A
F3 T1.6A
F4 T2.0A
F5 T3.15A
F6 T400mA
X7 2SD637S
X8 2SD637S
X9 2SD639S
X11 2SD637S
X12 2SD637S
X13 2SD637S
X14 2SD1128-02
X15 2SD637S
X16 2SD638R
X17 2SD1128-02
IC1 UPC78L05
RY1
TP-1 TP-2 TP-3 TP-4 TP-5 TP-6 TP-7 TP-8 TP-9 TP-10
10V REG. OUT
UNREG. 23V OUT
CAMERA 12V OUT
12V REG OUT
TUNER 12V OUT
15V REG. OUT
TUNER 40V OUT
DRUM 12V OUT
TUNER -23V OUT
TIMER 5.6V OUT
12V 12V 10V 5.6V POWER OFF TUNER OFF 22V GND GND
TO MCHA-CON 06
GND 25V
TO HEATOR
12V CAMERA OFF TUNER OFF 12V 12V GND
TO JUNCTION 07
VOLTAGE SELECTOR
110V ②-④⑤-⑦
127V ②-⑥③-⑤
220V — ④-⑦
240V — ⑦-⑧
F1 T1.6A
NOISE FILTER
CY 0.0033/400
CX 0.068/250
MAIN SW
AC IN 50Hz 110/127 220/240
10 POWER SUPPLY
GND GND -23V 5.6V 10V 10V 12V 15V 40V RESET
12V GND
22V GND 12V GND
12V 22V GND
TO T/T CONTROL 09
TO SERVO 2 02
TO SERVO 1 01
TO AUDIO 05

NOTES:

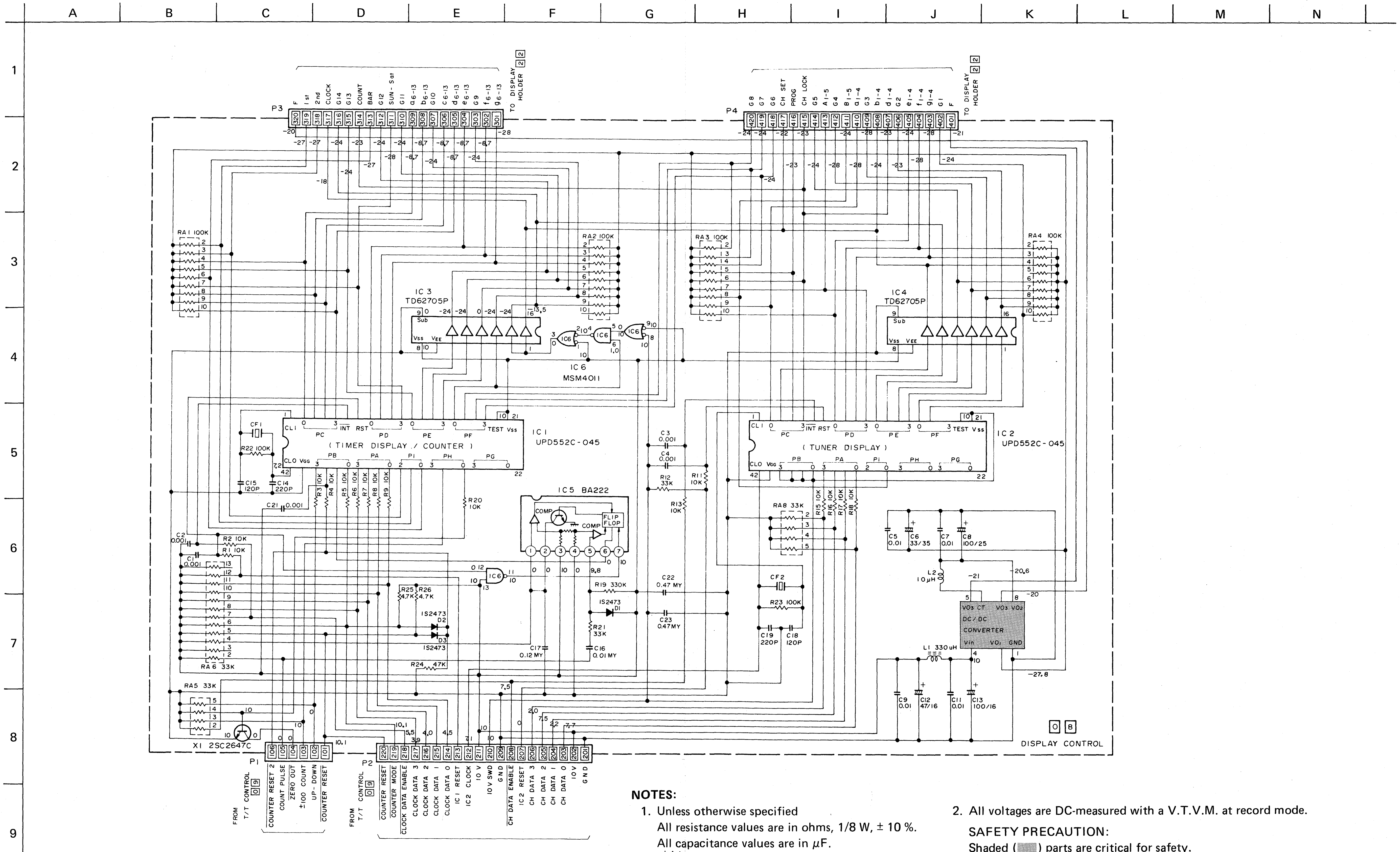
1. Unless otherwise specified;
   All resistance values are in ohms. (1/8W)
   OMR: Oxide metal film resistor
   MFR: Metal film resistor
   F R : Fusible resistor
   All capacitance values are in microfarads.
   —+||— Electrolytic
   MY —||— Mylar
   —||— Ceramic
   MM —||— Metallized mylar

2. All voltages are DC-measured with a V.T.V.M. at record mode.
   SAFETY PRECAUTION:
   Shaded (▨) parts are critical for safety. Replace only with part number specified.

8.31 POWER SUPPLY CIRCUIT BOARD


A
B
C
D
E
F
G
H
I
J
K
L
M
N
1
2
3
4
5
6
7
8
9
AC IN
AC 23 V
AC19 V
33
32
31
AC IN
AC 14.3 V
AC 12.5 V
14
13
12
11
F6 T400mA
F3 T1.6 A
F2 T2.5A
12 V ADJ.
AC18 V AC IN AC 14 V
24
23
22
21
F4 T2A
F5 T3.15A
45
44
43
42
41
16.4
X9
X11
X13
X14
X15
X16
X17
X7
X8
X12
R19
R23
R9
RY1
+12V
NO
NC
C
GND
DS2
DS3
IC1
TUNER
CAMERA
CAMERA (13.4)
12 V
13(TUNER)
TP-1
TP-2
TP-3
TP-4
TP-5
TP-6
TP-7
TP-8
TP-9
TP-10
TP-11
15 V ADJ.
10 V ADJ.

8.32 DISPLAY CONTROL CIRCUIT SCHEMATIC DIAGRAM


A
B
C
D
E
F
G
H
I
J
K
L
M
N
1
2
3
4
5
6
7
8
9
P3
TO DISPLAY HOLDER 2 2
P4
RA1 100K
RA2 100K
RA3 100K
RA4 100K
IC 3
TD62705P
IC4
TD62705P
IC6
MSM4011
IC 1
UPD552C-045
(TIMER DISPLAY / COUNTER)
IC 2
UPD552C-045
(TUNER DISPLAY)
IC5 BA222
COMP
FLIP FLOP
CF1
CF2
R22 100K
C15 120P
C14 220P
C21 0.001
R20 10K
C3 0.001
C4 0.001
R12 33K
R11 10K
R13 10K
RA8 33K
R15 10K
R16 10K
R17 10K
R18 10K
C5 0.01
C6 33/35
C7 0.01
C8 100/25
L2 10μH
DC/DC CONVERTER
L1 330uH
C9 0.01
C12 47/16
C11 0.01
C13 100/16
C22 0.47 MY
C23 0.47MY
R19 330K
1S2473 D1
R21 33K
C16 0.01MY
C17 0.12 MY
R25 4.7K
R26 4.7K
1S2473 D2
D3 1S2473
R24 47K
R23 100K
C19 220P
C18 120P
C2 0.001
C1 0.001
R2 10K
R1 10K
RA6 33K
RA5 33K
X1 2SC2647C
P1
FROM T/T CONTROL 0 9
COUNTER RESET 2
COUNT PULSE
ZERO OUT
±100 COUNT
UP-DOWN
COUNTER RESET
P2
FROM T/T CONTROL 0 9
COUNTER RESET
COUNTER MODE
CLOCK DATA ENABLE
CLOCK DATA 3
CLOCK DATA 2
CLOCK DATA 1
CLOCK DATA 0
IC1 RESET
IC2 CLOCK
10 V
10V SWD
GND
CH DATA ENABLE
IC2 RESET
CH DATA 3
CH DATA 2
CH DATA 1
CH DATA 0
10V
GND
0 8
DISPLAY CONTROL

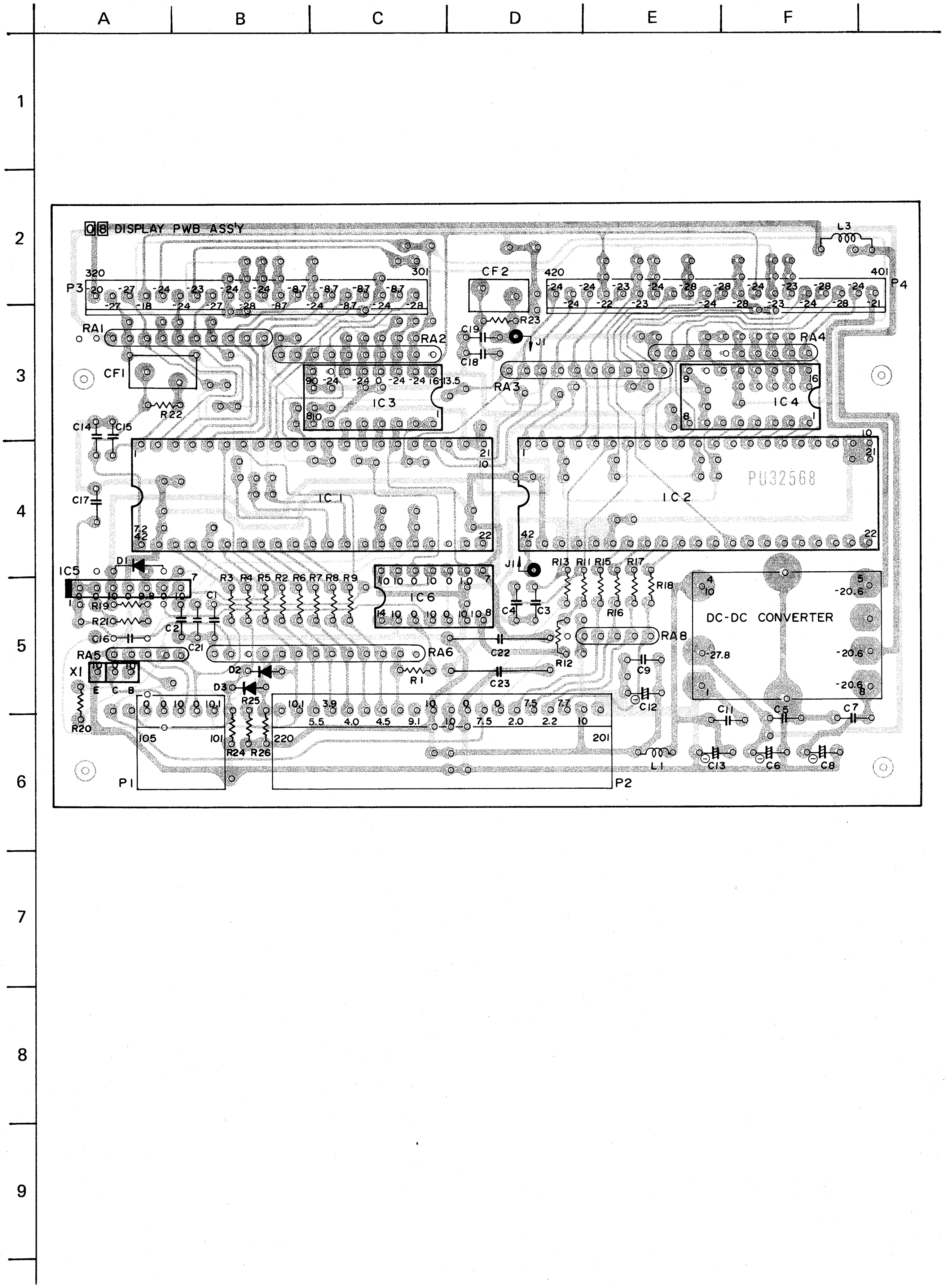
NOTES:

1. Unless otherwise specified
   All resistance values are in ohms, 1/8 W, ± 10 %.
   All capacitance values are in μF.
   Electrolytic
   MY Mylar
   Ceramic

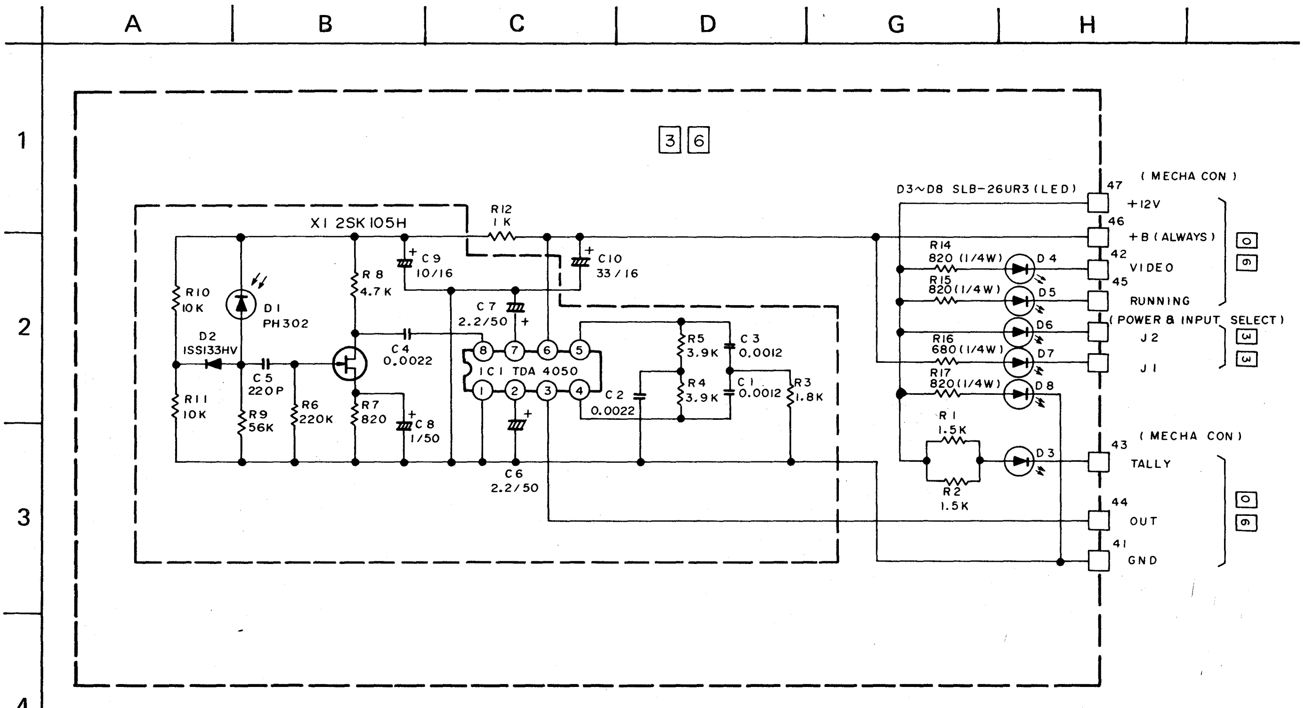
2. All voltages are DC-measured with a V.T.V.M. at record mode.

SAFETY PRECAUTION:
Shaded (▨) parts are critical for safety.
Replace only with part number specified.

8.33 DISPLAY CONTROL CIRCUIT BOARD

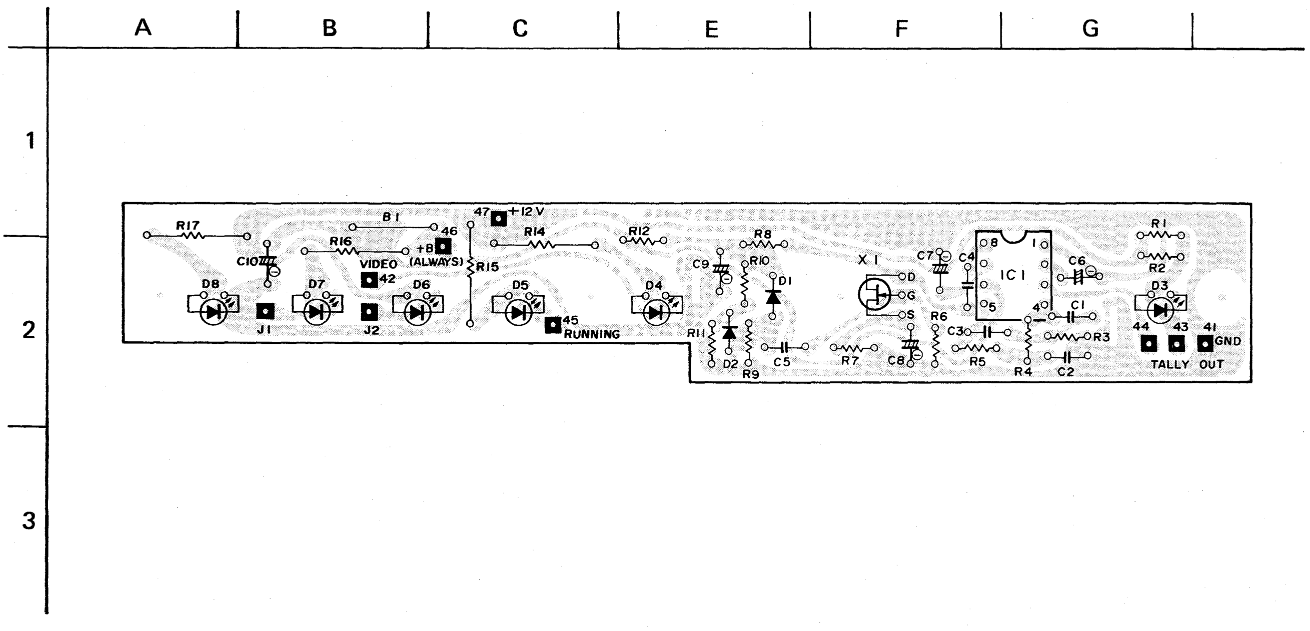

A
B
C
D
E
F
1
2
3
4
5
6
7
8
9
08 DISPLAY PWB ASS'Y
P3
320
301
CF2
420
401
P4
L3
RA1
RA2
RA3
RA4
R23
C19
C18
J1
CF1
R22
IC3
IC4
C14
C15
C17
IC1
IC2
PU32568
D1
IC5
R19
R21
C16
C1
C2
C21
R3 R4 R5 R2 R6 R7 R8 R9
IC6
C4
C3
R13 R11 R15 R17
R16
R18
DC-DC CONVERTER
-20.6
-27.8
RA5
X1
E C B
RA6
C22
R12
RA8
C9
C12
D2
D3
R1
C23
R25
R24 R26
R20
105
101
220
201
P1
P2
C11
C5
C7
L1
C13
C6
C8

8.34 IFR RECEIVER CIRCUIT SCHEMATIC DIAGARM

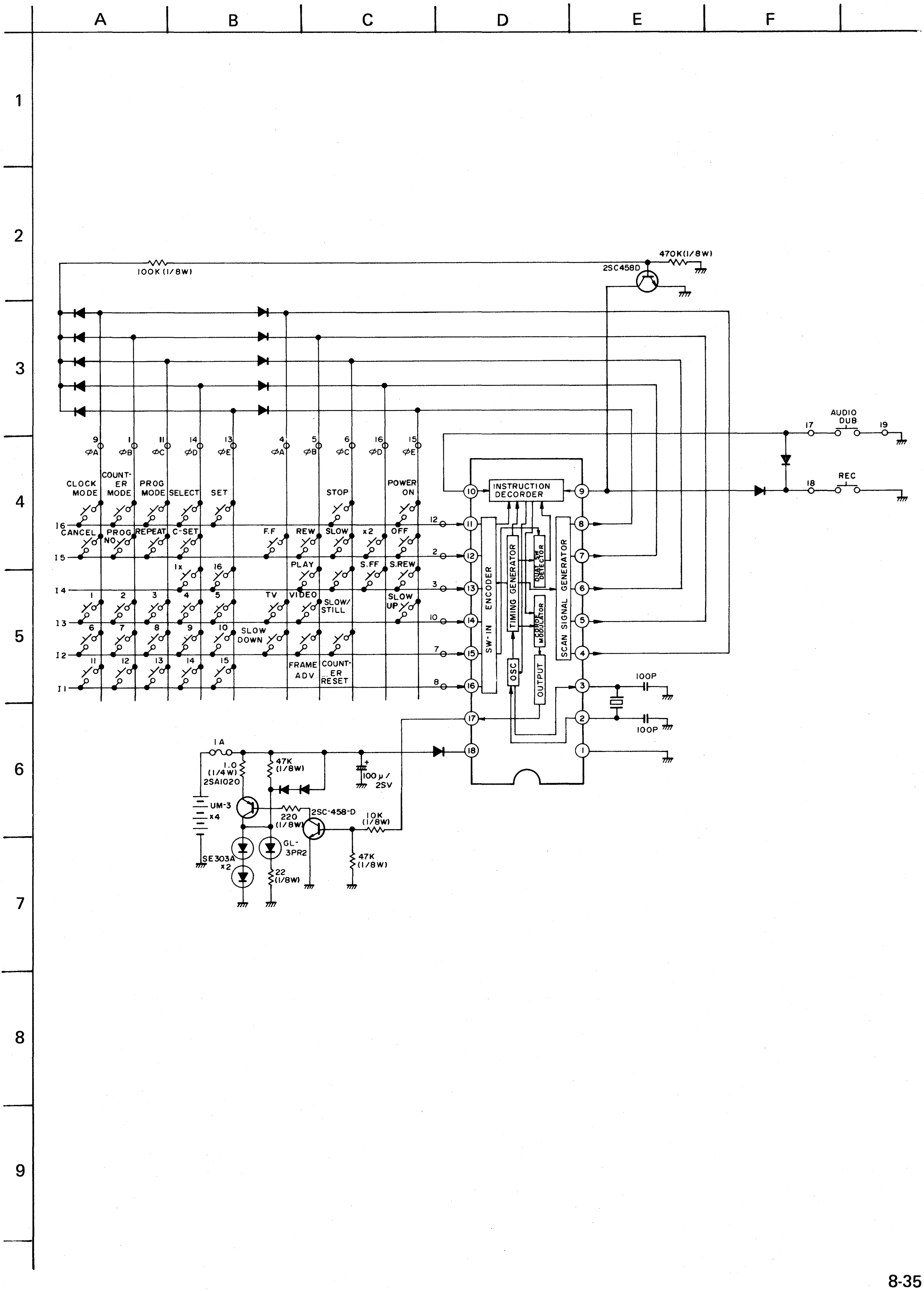

A
B
C
D
G
H
1
2
3
4
3 6
X1 2SK105H
R12 1K
C9 10/16
C10 33/16
R10 10K
D1 PH302
R8 4.7K
C7 2.2/50
D2 1SS133HV
C4 0.0022
C5 220P
IC1 TDA 4050
R11 10K
R9 56K
R6 220K
R7 820
C8 1/50
C6 2.2/50
C2 0.0022
R5 3.9K
C3 0.0012
R4 3.9K
C1 0.0012
R3 1.8K
D3~D8 SLB-26UR3 (LED)
R14 820 (1/4W)
R15 820 (1/4W)
R16 680 (1/4W)
R17 820 (1/4W)
D4
D5
D6
D7
D8
R1 1.5K
R2 1.5K
D3
47
46
42
45
43
44
41
(MECHA CON)
+12V
+B (ALWAYS)
VIDEO
RUNNING
(POWER & INPUT SELECT)
J2
J1
TALLY
OUT
GND
0 6
3 3

(NOTE)
UNLESS OTHERWISE SPECIFIED ;
ALL RESISTANCE VALUES ARE IN OHMS. 1/8 W (EXCEPT R14, R15, R16, R17)
ALL CAPACITANCE VALUES ARE IN μF. P ; $\mu\mu$F
⊣⊢ ELECTROLYTIC
⊣⊢ MYLAR OR CERAMIC
D4 & R14 ARE ONLY USED AT SECAM TYPE MODEL

– IFR REVEIVER CIRCUIT BOARD –


A
B
C
E
F
G
1
2
3
R17
B1
47
+12V
R16
46
+B
R14
R12
R8
R1
C10
VIDEO
(ALWAYS)
R15
C9
R10
X1
C7
C4
IC1
C6
R2
D8
D7
42
D6
D5
D4
D1
D
G
S
D3
J1
J2
45
RUNNING
R11
D2
R9
C5
R7
C8
R6
C3
R5
R4
C1
R3
C2
44
43
41
GND
TALLY
OUT

8.35 REMOTE CONTROLLER CIRCUIT SCHEMATIC DIAGRAM


A
B
C
D
E
F
1
2
3
4
5
6
7
8
9
100K (1/8W)
470K(1/8W)
2SC458D
9 ⌀A
1 ⌀B
11 ⌀C
14 ⌀D
13 ⌀E
4 ⌀A
5 ⌀B
6 ⌀C
16 ⌀D
15 ⌀E
CLOCK MODE
COUNT-ER MODE
PROG MODE
SELECT
SET
STOP
POWER ON
CANCEL
PROG NO
REPEAT
C-SET
F.F
REW
SLOW
x2
OFF
1x
16
PLAY
S.FF
S.REW
1
2
3
4
5
TV
VIDEO
SLOW UP
SLOW/ STILL
6
7
8
9
10
SLOW DOWN
11
12
13
14
15
FRAME ADV
COUNT-ER RESET
I6
I5
I4
I3
I2
I1
12
2
3
10
7
8
INSTRUCTION DECORDER
SW-IN ENCODER
TIMING GENERATOR
DUAL SW DETECTOR
CODE MODULATOR
SCAN SIGNAL GENERATOR
OSC
OUTPUT
AUDIO DUB
17
19
REC
18
100P
100P
1A
1.0 (1/4W)
2SA1020
47K (1/8W)
100μ / 25V
UM-3 x4
220 (1/8W)
2SC-458-D
10K (1/8W)
GL-3PR2
SE303A x2
22 (1/8W)
47K (1/8W)

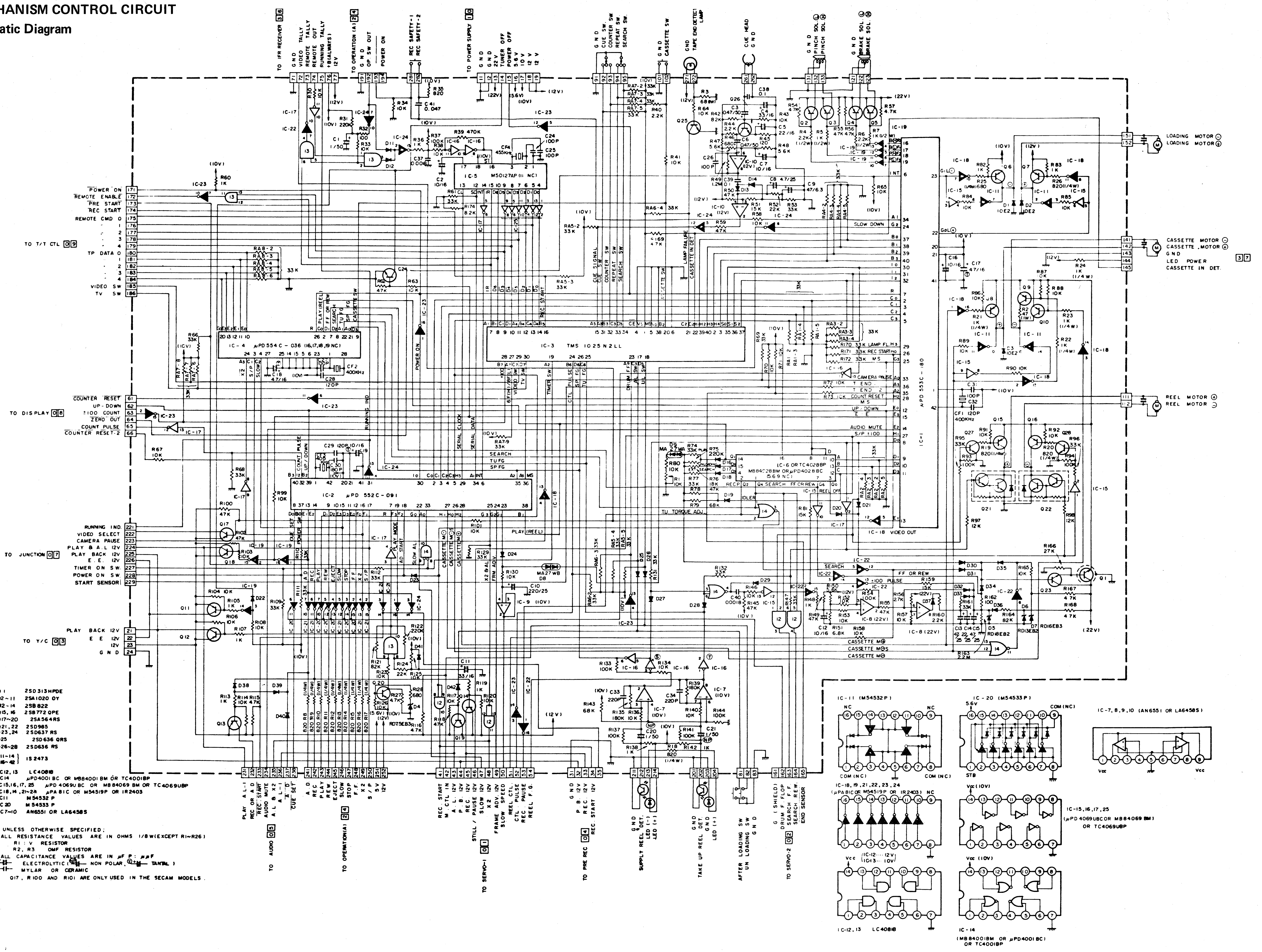
REVISED MECHANICAL CONTROL CIRCUIT

Affected models	Service manual numbers
HR-7700EK	No. 8176
HR-7700ER	No. 8200
HR-7700S	No. 8189

Note: Affected Serial Numbers : From January, 1982 production

8.36 NEW MECHANISM CONTROL CIRCUIT

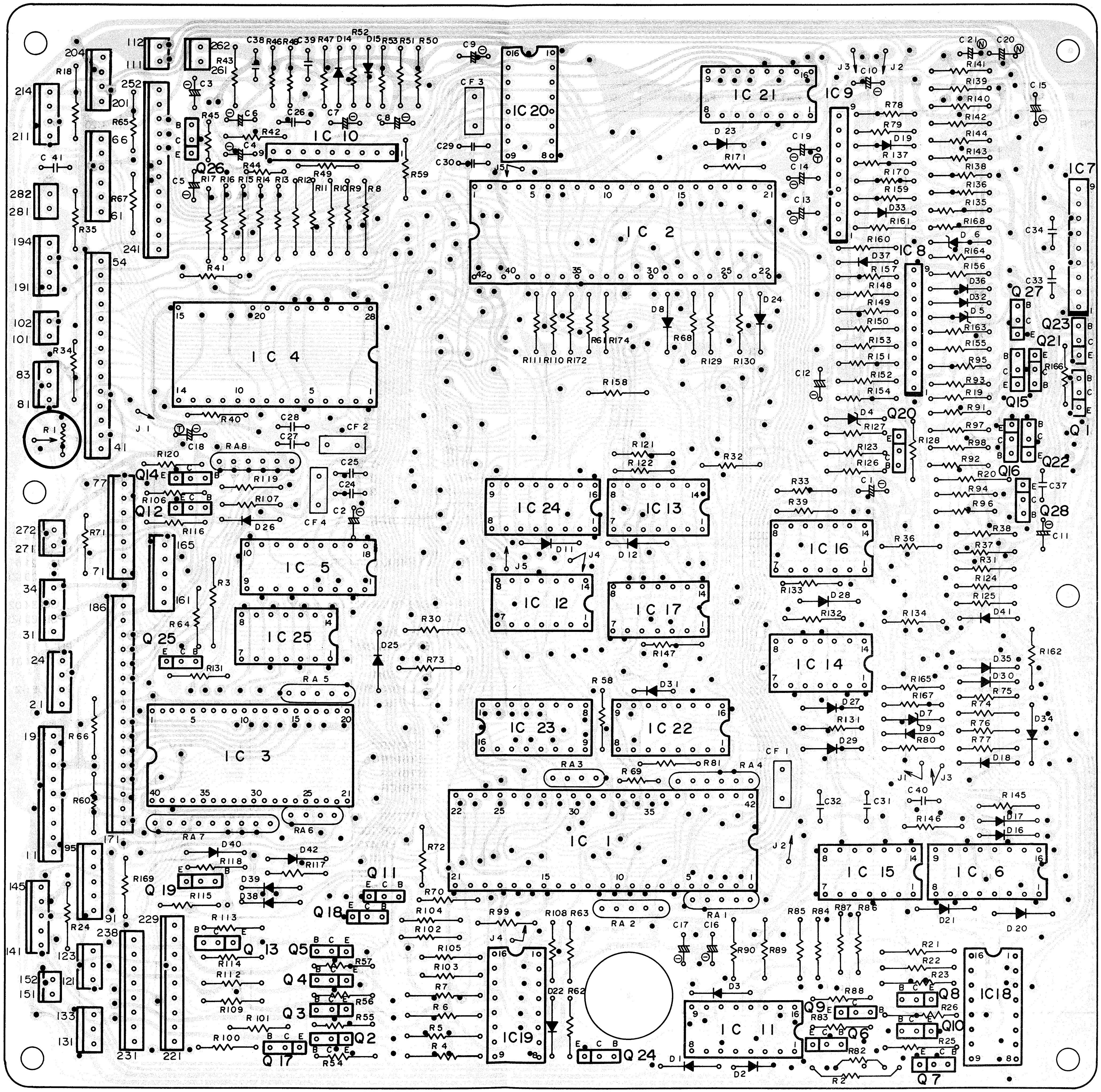
8.36.1 Schematic Diagram


TO IFR RECEIVER 16
GND
VIDEO TALLY
REMOTE TALLY
REMOTE OUT
RUNNING TALLY
+B(ALWAYS)
12V
TO OPERATION (A) 24
GND
OP SW OUT
POWER ON
REC SAFETY-1
REC SAFETY-2
TO POWER SUPPLY 1G
GND
GND
22V
TUNER OFF
POWER OFF
5.6V
10V
12V
12V
GND
CUE SW
COUNTER SW
REPEAT SW
SEARCH SW
GND
CASSETTE SW
GND
TAPE END DETECT LAMP
CUE HEAD
GND
GND
PINCH SOL
PINCH SOL
GND
BRAKE SOL
BRAKE SOL
LOADING MOTOR
LOADING MOTOR
CASSETTE MOTOR
CASSETTE MOTOR
GND
LED POWER
CASSETTE IN DET.
37
REEL MOTOR
REEL MOTOR
POWER ON
REMOTE ENABLE
PRE START
REC START
REMOTE CMD 0
TO T/T CTL 09
TP DATA 0
VIDEO SW
TV SW
COUNTER RESET
UP-DOWN
±100 COUNT
ZERO OUT
COUNT PULSE
COUNTER RESET-2
TO DISPLAY 08
RUNNING IND.
VIDEO SELECT
CAMERA PAUSE
PLAY & A.L 12V
PLAY BACK 12V
E.E. 12V
TIMER ON SW.
POWER ON SW
START SENSOR
TO JUNCTION 07
PLAY BACK 12V
E E 12V
12V
GND
TO Y/C 03
IC-5 M50127AP (11 NC)
IC-4 μPD554C-036 (16,17,18,19 NC)
IC-3 TMS 1025 N2LL
IC-2 μPD 552C-091
IC-1 μPD 553C-180
IC-6 OR TC4028BP MB84C28BM OR μPD4028BC (15,6,9 NC)
TU TORQUE ADJ.
PLAY AL-1
REC OR AD
REC START
AUDIO MUTE
A.L. & A.L-1
CUE SET
TO AUDIO 05
A.D
REC
PLAY
REW
EJECT
SLOW
STOP
F.F
X2
S/P
5V
12V
TO OPERATION(A) 24
REC START
M.CTL IN
A.L 12V
P.B 12V
REC 12V
STILL / PAUSE 12V
SLOW 12V
X2 12V
FRAME ADV 12V
SLOW SPEED
REEL CTL
CTL PULSE
CTL PAUSE
REEL F.G.
TO SERVO-1 01
GND
P.B 12V
REC 12V
REC START
TO PRE REC 04
GND
SUPPLY REEL DET.
LED
LED (+)
GND
TAKE UP REEL DET.
GND
LED (+)
AFTER LOADING SW
UN LOADING SW
GND
G (SHIELD)
DRUM F.FLOP
SEARCH F.F
SEARCH REW.
END SENSOR
TO SERVO-2 02
IC-11 (M54532P)
IC-20 (M54533P)
IC-7,8,9,10 (AN6551 OR LA6458S)
IC-18,19,21,22,23,24 (μPA81C OR M54519P OR IR2403)
IC-15,16,17,25 (μPD 4069UBC OR MB84069BM) OR TC4069UBP
IC-12,13 LC4081B
IC-14 (MB84001BM OR μPD4001BC) OR TC4001BP

Q1	2SD313HPDE
Q2~11	2SA1020 OY
Q12~14	2SB822
Q15, 16	2SB772 QPE
Q17~20	2SA564RS
Q21, 22	2SD985
Q23, 24	2SD637 RS
Q25	2SD636 QRS
Q26~28	2SD636 RS
D11~14 16~42	1S2473
IC12, 13	LC4081B
IC14	μPD4001BC OR MB84001BM OR TC4001BP
IC15,16,17,25	μPD 4069UBC OR MB84069BM OR TC4069UBP
IC18,14,21~24	μPA81C OR M54519P OR IR2403
IC11	M54532P
IC20	M54533P
IC7~10	AN6551 OR LA6458S

NOTE UNLESS OTHERWISE SPECIFIED;
ALL RESISTANCE VALUES ARE IN OHMS 1/8W (EXCEPT R1~R26)
R1 : V RESISTOR
R2, R3 OMF RESISTOR
ALL CAPACITANCE VALUES ARE IN μF P: μμF
⊣⊢ ELECTROLYTIC (NP NON POLAR, T TANTAL)
⊣⊢ MYLAR OR CERAMIC
Q17, R100 AND R101 ARE ONLY USED IN THE SECAM MODELS.

8.36.2 Circuit Board



IC 1
IC 2
IC 3
IC 4
IC 5
IC 6
IC7
IC8
IC9
IC 10
IC 11
IC 12
IC13
IC 14
IC 15
IC 16
IC 17
IC18
IC19
IC20
IC 21
IC 22
IC 23
IC 24
IC 25
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Q14
Q15
Q16
Q17
Q18
Q19
Q20
Q21
Q22
Q23
Q24
Q 25
Q26
Q 27
Q28
RA 1
RA 2
RA 3
RA 4
RA 5
RA 6
RA 7
RA 8
CF 1
CF 2
CF 3
CF 4
J1
J2
J3
J4
J5
R 1
C38
R46
R48
C39
R47
D14
R52
D15
R53
R51
R50
R43
R45
R42
R44
R49
R59
R17
R16
R15
R14
R13
R12
R11
R10
R9
R8
R41
R40
R18
R65
R67
R35
R34
C3
C4
C5
C6
C7
C8
C9
C10
C26
C29
C30
C41
C18
C27
C28
C24
C25
C2
R120
R119
R107
R106
R116
D26
R71
R3
R64
R131
R30
R73
D25
R66
R60
R72
R70
R104
R102
R105
R103
R7
R6
R5
R4
R99
R108
R63
R62
D22
D40
R118
D42
R117
D39
D38
R169
R115
R113
R114
R112
R109
R101
R100
R57
R56
R55
R54
R24
D23
R171
C19
C14
C13
R78
R79
D19
R137
R170
R159
D33
R161
R160
D37
R157
R148
R149
R150
R153
R151
R152
R154
D4
R127
R123
R126
R128
R141
R139
R140
R142
R144
R143
R138
R136
R135
R168
D6
R164
R156
D36
D32
D5
R163
R155
R95
R93
R19
R91
R97
R98
R92
R20
R94
R96
R166
C21
C20
C15
C34
C33
C37
C11
C12
R111
R110
R172
R61
R174
D8
R68
R129
R130
D24
R158
R121
R122
R32
R33
R39
C1
R36
R38
R37
R31
R124
R125
D41
R134
R133
D28
R132
D11
D12
R147
R58
D31
R69
R81
R162
D35
D30
R75
R74
R76
R77
D18
D34
R165
R167
D27
D7
D9
R80
D29
C32
C31
C40
R145
R146
D17
D16
D21
D20
R85
R84
R87
R86
C17
C16
R90
R89
D3
D1
D2
R88
R83
R82
R2
R21
R22
R23
R26
R25
112
111
262
261
204
201
214
211
66
61
252
241
282
281
194
191
102
101
83
81
54
41
77
71
272
271
165
161
34
31
186
24
21
19
11
171
95
91
145
141
123
121
152
151
133
131
238
231
229
221
B
C
E

8.36.3 Electrical Parts List

MECHANICAL CONTROL CIRCUIT BOARD ASS'Y

0 6 .... PU10458A-M (EK and ER)
.... PU10458B-M (S)

Symbol No.	Part No.	Part Name	Description
IC 1	UPD553C-180	Integrated Circuit	
IC 2	UPD552C-091	″	
IC 3	TMS1025N2LL	″	
IC 4	UPD554C-036	″	
IC 5	M50127AP	″	
IC 6	MB84028BM	″	or UPD4028BC, TC4028BP
IC 7	AN6551	″	or LA6458S
IC 8	″	″	or ″
IC 9	″	″	or ″
IC10	″	″	or ″
IC11	M54532P	″	
IC12	LC4081B	″	
IC13	″	″	
IC14	UPD4001BC	″	or MB84001BM, TC4001BP
IC15	UPD4069UBC	″	or MB84069BM, TC4069UBP
IC16	″	″	or ″
IC17	″	″	or ″
IC18	UPA81C	″	or M54519P, IR2403
IC19	″	″	or ″
IC20	M54533P	″	
IC21	UPA81C	″	or M54519P, IR2403
IC22	″	″	or ″
IC23	″	″	or ″
IC24	″	″	or ″
IC25	UPD4069UBC	″	or MB84069BM, TC4069UBP
Q 1	2SD313HPDE	Transistor	
Q 2	2SA1020OY	″	
Q 3	″	″	
Q 4	″	″	
Q 5	″	″	
Q 6	″	″	
Q 7	″	″	
Q 8	″	″	
Q 9	″	″	
Q10	″	″	
Q11	2SB822	″	
Q12	″	″	
Q13	″	″	
Q14	″	″	
Q15	2SB772QPE	″	
Q16	″	″	
Q17	2SA564RS	″	″S″ only
Q18	″	″	
Q19	″	″	
Q20	″	″	
Q21	2SD985	″	
Q22	″	″	
Q23	2SD637RS	″	
Q24	″	″	
Q25	2SD636QRS	″	
Q26	2SD636RS	″	
Q27	2SD636RS	″	
Q28	″	″	
D 1	10E2	Diode	
D 2	″	″	
D 3	″	″	
D 4	RD7.5EB3	Zener Diode	
D 5	RD18EB2	″	
D 6	RD13EB2	″	
D 7	RD16EB3	″	
D 8	MA27WB	Diode	
D 9	MA27WA	″	
D10	—	—	
D11	1S2473	Diode	
D12	″	″	
D13	″	″	
D14	″	″	
D15	—	—	
D16	1S2473	Diode	
D17	″	″	
D18	″	″	
D19	″	″	
D20	″	″	
D21	″	″	
D22	″	″	
D23	″	″	
D24	″	″	
D25	″	″	
D26	″	″	
D27	″	″	
D28	″	″	
D29	″	″	
D30	″	″	
D31	″	″	
D32	″	″	
D33	″	″	
D34	″	″	
D35	″	″	
D36	″	″	
D37	″	″	
D38	″	″	
D39	″	″	
D40	″	″	
D41	″	″	
D42	″	″	
R 1	QVP4A0B-103	VR	10 K
R 2	QRG019J-470	OMF R	47
R 3	″ -680	″	68
R 4	QRD121J-222	CR	2.2 K
R 5	″ -102	″	1 K
R 6	″ -222	″	2.2 K
R 7	″ -102	″	1 K
R 8	QRD141J-821	″	820
R 9	″ -821	″	820
R10	″ -821	″	820
R11	″ -821	″	820
R12	″ -821	″	820
R13	″ -821	″	820
R14	″ -821	″	820
R15	″ -821	″	820
R16	″ -821	″	820
R17	″ -821	″	820
R18	″ -821	″	820
R19	″ -821	″	820
R20	QRD141J-821	CR	820
R21	″ -102	″	1 K
R22	″ -102	″	1 K
R23	″ -102	″	1 K
R24	″ -102	″	1 K
R25	″ -681	″	680
R26	″ -821	″	820
R27	—	—	
R28	—	—	
R29	—	—	
R30	QRD181J-103	CR	10 K
R31	″ -224	″	220 K
R32	″ -101	″	100
R33	″ -103	″	10 K
R34	″ -103	″	10 K
R35	″ -821	″	820
R36	″ -102	″	1 K
R37	″ -104	″	100 K
R38	″ -103	″	10 K
R39	″ -474	″	470 K
R40	″ -222	″	2.2 K
R41	″ -103	″	10 K
R42	″ -823	″	82 K
R43	″ -103	″	10 K
R44	″ -222	″	2.2 K
R45	″ -121	″	120
R46	″ -681	″	680
R47	″ -562	″	5.6 K
R48	″ -562	″	5.6 K
R49	″ -125	″	1.2 M
R50	″ -473	″	47 K
R51	″ -153	″	15 K
R52	″ -223	″	22 K
R53	″ -333	″	33 K
R54	″ -472	″	4.7 K
R55	″ -472	″	4.7 K
R56	″ -472	″	4.7 K
R57	″ -472	″	4.7 K
R58	″ -103	″	10 K
R59	″ -473	″	47 K
R60	″ -102	″	1 K
R61	″ -333	″	33 K
R62	″ -473	″	47 K
R63	″ -103	″	10 K
R64	″ -103	″	10 K
R65	″ -103	″	10 K
R66	″ -333	″	33 K
R67	″ -103	″	10 K
R68	″ -333	″	33 K
R69	″ -333	″	33 K
R70	″ -103	″	10 K
R71	″ -103	″	10 K
R72	″ -103	″	10 K
R73	″ -103	″	10 K
R74	″ -333	″	33 K
R75	″ -224	″	220 K
R76	″ -183	″	18 K
R77	″ -333	″	33 K
R78	″ -473	″	47 K
R79	″ -683	″	68 K
R80	″ -103	″	10 K
R81	″ -153	″	15 K
R82	″ -102	″	1 K
R83	QRD181J-102	CR	1 K
R84	″ -103	″	10 K
R85	″ -103	″	10 K
R86	″ -103	″	10 K
R87	″ -103	″	10 K
R88	″ -103	″	10 K
R89	″ -103	″	10 K
R90	″ -103	″	10 K
R91	″ -103	″	10 K
R92	″ -103	″	10 K
R93	″ -104	″	100 K
R94	″ -104	″	100 K
R95	″ -333	″	33 K
R96	″ -333	″	33 K
R97	″ -123	″	12 K
R98	″ -123	″	12 K
R99	″ -103	″	10 K
R100	″ -473	″	47 K ″S″ only
R101	″ -103	″	10 K ″S″ only
R102	″ -473	″	47 K
R103	″ -103	″	10 K
R104	″ -103	″	10 K
R105	″ -102	″	1 K
R106	″ -103	″	10 K
R107	″ -102	″	1 K
R108	″ -103	″	10 K
R109	″ -333	″	33 K
R110	″ -333	″	33 K
R111	″ -333	″	33 K
R112	″ -333	″	33 K
R113	″ -102	″	1 K
R114	″ -103	″	10 K
R115	″ -472	″	4.7 K
R116	″ -472	″	4.7 K
R117	″ -103	″	10 K
R118	″ -473	″	47 K
R119	″ -102	″	1 K
R120	″ -103	″	10 K
R121	″ -823	″	82 K
R122	″ -224	″	220 K
R123	″ -103	″	10 K
R124	″ -223	″	22 K
R125	″ -103	″	10 K
R126	″ -103	″	10 K
R127	″ -472	″	4.7 K
R128	″ -681	″	680
R129	″ -333	″	33 K
R130	″ -103	″	10 K
R131	″ -333	″	33 K
R132	″ -333	″	33 K
R133	″ -104	″	100 K
R134	″ -103	″	10 K
R135	″ -184	″	180 K
R136	″ -103	″	10 K
R137	″ -104	″	100 K
R138	″ -102	″	1 K
R139	″ -184	″	180 K
R140	″ -103	″	10 K
R141	″ -104	″	100 K
R142	″ -102	″	1 K
R143	″ -683	″	68 K
R144	″ -104	″	100 K
R145	″ -473	″	47 K

Symbol No.	Part No.	Part Name	Description
R146	QRD181J-103	CR	10 K
R147	〃 -333	〃	33 K
R148	〃 -102	〃	1 K
R149	〃 -473	〃	47 K
R150	〃 -562	〃	5.6 K
R151	〃 -682	〃	6.8 K
R152	〃 -103	〃	10 K
R153	〃 -103	〃	10 K
R154	〃 -104	〃	100 K
R155	〃 -473	〃	47 K
R156	〃 -272	〃	2.7 K
R157	〃 -103	〃	10 K
R158	〃 -103	〃	10 K
R159	〃 -153	〃	15 K
R160	〃 -222	〃	2.2 K
R161	〃 -333	〃	33 K
R162	〃 -101	〃	100
R163	〃 -225	〃	2.2 M
R164	〃 -823	〃	82 K
R165	〃 -103	〃	10 K
R166	〃 -273	〃	27 K
R167	〃 -472	〃	4.7 K
R168	〃 -472	〃	4.7 K
R169	〃 -472	〃	4.7 K
R170	〃 -333	〃	33 K
R171	〃 -333	〃	33 K
R172	〃 -333	〃	33 K
R173	–	–	
R174	QRD181J-822	CR	8.2 K
RB 1	QRD181J-0R0	CR	0
RA 1	EXB-P84333M	Resistor Array	
RA 2	〃	〃	
RA 3	FRE3333M	〃	
RA 4	EXB-P84333M	〃	
RA 5	〃	〃	
RA 6	FRE3333M	〃	
RA 7	EXB-P88333M	〃	
RA 8	EXB-P85333M	〃	
C 1	QET41HR-105	E Cap	1 50 V
C 2	QET61CR-106	〃	10 16 V
C 3	QET61HR-474	〃	0.47 50 V
C 4	QET61CR-336	〃	33 16 V
C 5	〃 -226	〃	22 〃
C 6	QET61HR-474	〃	0.47 50 V
C 7	QET41CR-106	〃	10 16 V
C 8	QET61ER-475	〃	4.7 25 V
C 9	QET40JR-476	〃	47 6.3 V
C10	QET61ER-227	〃	220 25 V
C11	QET41CR-336	〃	33 16 V
C12	〃 -106	〃	10 〃
C13	QET61ER-476	〃	47 25 V
C14	QET41ER-226	〃	22 〃
C15	QET61ER-476	〃	47 〃
C16	QEK51CM-106	〃	10 16 V
C17	QEE51CM-475	T Cap	4.7 〃
C18	〃 -475	〃	4.7 〃
C19	〃 -106	〃	10 〃

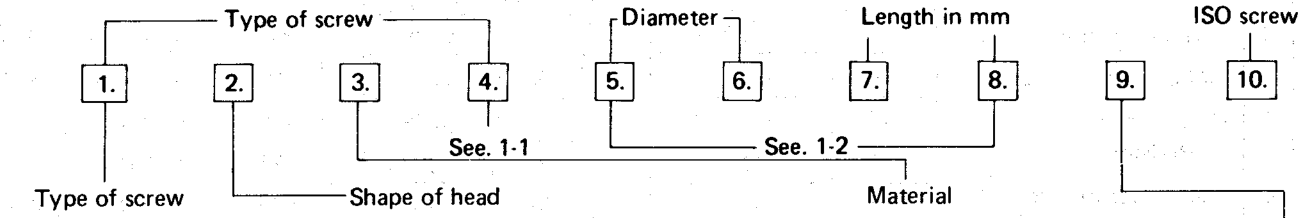
Symbol No.	Part No.	Part Name	Description
C20	QEN41HM-105	NP Cap	1 50 V
C21	〃 -105	〃	1 〃
C22	–	–	
C23	–	–	
C24	QCS31HJ-101	C Cap	100 P 50 V
C25	〃 -101	〃	100 P 〃
C26	〃 -101	〃	100 P 〃
C27	〃 -101	〃	100 P 〃
C28	〃 -121	〃	120 P 〃
C29	〃 -121	〃	120 P 〃
C30	〃 -181	〃	180 P 〃
C31	〃 -101	〃	100 P 〃
C32	〃 -121	〃	120 P 〃
C33	〃 -221	〃	220 P 〃
C34	〃 -221	〃	220 P 〃
C35	–	–	
C36	–	–	
C37	QFN31HK-182	MY Cap	0.0018 50 V
C38	QFN41HK-104	〃	0.1 〃
C39	〃 -104	〃	0.1 〃
C40	QFN31HK-182	〃	0.0018 〃
C41	〃 -473	〃	0.047 〃
CF 1	PU50224	Ceramic Filter	
CF 2	〃	〃	
CF 3	〃	〃	
CF 4	PU49487-1	〃	
	PU33312	Heat Sink	for Q1
	PU45375-3	Transistor Spacer	
	PU41624-6	Isolation Washer	
	DPSP3006ZS	Screw	
	Q03093-802	Washer	for Heat Sink
	DPSP3006ZS	Screw	
	PU33311	PWB Frame	
	E48729-001	Plastic Rivet	
	PU43351-2	Cap Housing	101–102, 111–112, 151–152, 261–262, 271–272, 281–282
	〃 -3	〃	81–83, 121–123 131–133
	〃 -4	〃	21–24, 31–34, 191–194, 201–204, 211–214
	〃 -5	〃	91–95, 141–145, 161–165
	〃 -6	〃	61–66
	〃 -7	〃	71–77
	〃 -8	〃	231–238
	〃 -9	〃	11–19, 221–229
	〃 -12	〃	241–252
	〃 -14	〃	41–54
	〃 -16	〃	171–186

SECTION 9
ELECTRICAL PARTS LIST

9.1 SAFETY PRECAUTION

**Parts identified by the ⚠ symbol are critical for safety. Replace only with specified part numbers.
For maximum reliability and performance, all other replacement parts should be identical to those specified.**

9.2 SCREW/WASHER/E-RING



Type of screw
Diameter
Length in mm
ISO screw
1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
See. 1-1
See. 1-2
Type of screw
Shape of head
Material

S	Normal screw
N	Assembly screw
L	"
D	"
G	"
M	W. Wood screw
F	Feather screw
T	Setscrew
Y	"
B	Bolt
N	Nut
W	Washer
R	E-ring
E	–
P	Spring

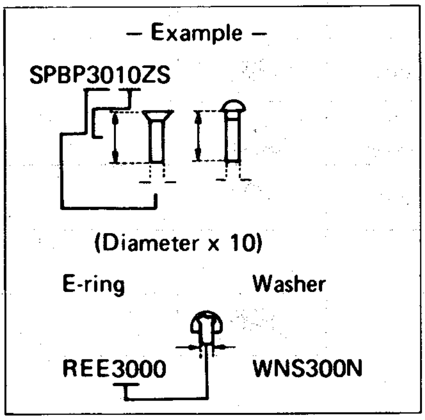
P		Pan head
S		Flat countersunk head
H		Oval countersunk head
D		Binding head
R		Round head
B		Round head
T		Truss head

Symbol letter	Material
S	Steel
E	Stainless steel
C	Cast iron
U	Bronze
B	Brass
P	Phosphor bronze
N	German silver
Y	Brass
A	Aluminum
Z	Zinc-alloy
K	Polycarbonate

9.2.1 Type of screw

P	Cross-Recessed head screw
A	Tapping screw
B	Tapping screw
T	Tapping screw

9.2.2 Diameter and Length of screw

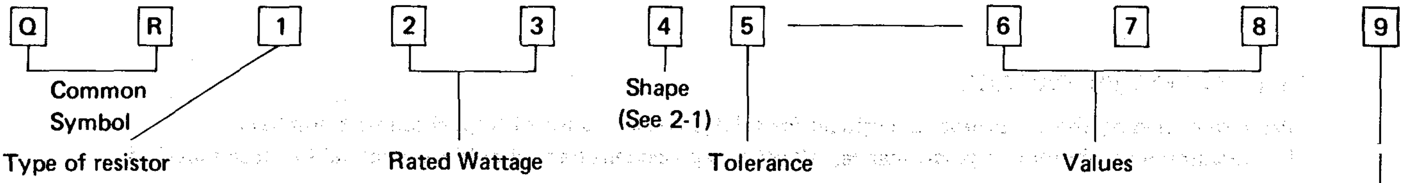


– Example –
SPBP3010ZS
(Diameter x 10)
E-ring
Washer
REE3000
WNS300N

Surface treatment

Symbol letter	Surface treatment
Z	Galvanization, dichromic acid treatment (MFZn2-C)
N	Nickel plating (MFNi2, MFNi1)
R	Chrome plating (MBCr2, MBCr1)
G	Silver plating (SP4)
W	Nichrome platings
P	Phosphite treatment
B	Bronze plating
M	Black coloring after galvanization
A	Red coloring after galvanization
C	Blue coloring after galvanization
T	Green coloring after galvanization
V	Violet coloring after galvanization
F	Iron with black coloring

9.3 FIXED RESISTOR CODING


Q
R
1
2
3
4
5
6
7
8
9
Common Symbol
Type of resistor
Rated Wattage
Shape (See 2-1)
Tolerance
Values

C	Composition Resistor
D	Carbon Resistor
F	Unflamable Resistor
G	Oxide Metal Film Resistor
M	Metal Plate Resistor
X	Metal Film Resistor
W	Wire Wound Resistor
Y	Wire Wound Resistor
V	Metal Film Resistor, High Stability
Z	Special Resistor

Symbol	Rated wattage
16	1/6 (W)
18	1/8 ″
14	1/4 ″
12	1/2 ″
01	1 ″
02	2 ″
03	3 ″
04	4 ″
05	5 ″
06	6 ″
07	7 ″
75	7.5 ″
08	8 ″
10	10 ″
15	15 ″
20	20 ″
30	30 ″

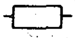
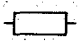
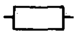
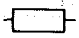
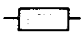
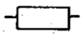
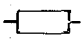
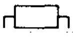
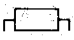
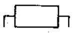
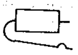
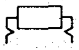
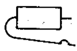
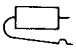
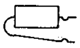
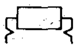
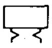
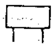
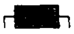
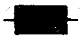
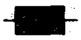
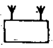
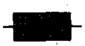
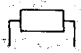
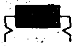
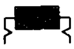
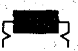
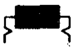
Symbol	Tolerance
F	±1 %
G	±2 %
J	±5 %
K	±10 %
M	±20 %

— Example —		
R47		0.47 Ω
4R7		4.7 Ω
470	47×10^0	47 Ω
471	47×10^1	470 Ω
472	47×10^2	4.7 KΩ
473	47×10^3	47 KΩ
474	47×10^4	470 KΩ
475	47×10^5	4.7 MΩ
10R2		10.2 Ω
1430	143×10^0	143 Ω
1581	158×10^1	1.58 KΩ

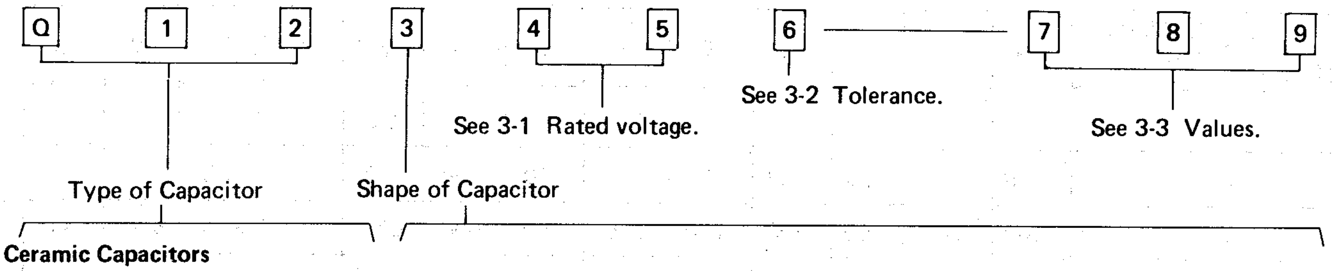
Size

Symbol	Size
A	Small Size
S	Small Size

9.3.1 Shape of resistor (■ : Flame retardant resistor)

Sort	C	D	G	F	M	W	X	Y	V
1									
2									
3									
4									
5						L type			
6						Resin Covered			
7						Enameled			
8									
9									

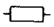
9.4 FIXED CAPACITOR CODING


Q
1
2
3
4
5
6
7
8
9
See 3-1 Rated voltage.
See 3-2 Tolerance.
See 3-3 Values.
Type of Capacitor
Shape of Capacitor

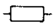
Ceramic Capacitors

Symbol	Type of Capacitor	Disk Lead 	Kink Lead 	
QCF	Ceramic	1	3	
QCS	〃	1	3	
QCY	〃	1, 4	3	
QCT	Temperature compensation			
QCZ	Special			

Electrolytic Capacitors

Symbol	Type of Capacitor	Tubular 	Mono-direction 	Anti-stress 	Forming 	Snap-in
QEA	Characteristic A	2	4			
QED	Characteristic D	2	4			
QEE	Tantalum		4	5		
QEE	〃 (small type)		8			
QEN	Non-polar	2	4	5	6	
QET	Characteristic W (small type)	2	4	5	6	
QEW	Characteristic W	2	4	5	6	7
QEZ	Special					

Paper Film Capacitors

Symbol	Type of Capacitor	Tubular 	Normal		Flame retardant	
			Mono-direction 	Kink Lead 	Mono-direction 	Kink Lead
QFF	Film mica		4			
QFH	Metalized mylar	2	4	3	5	6
QFM	Mylar	2	4	3, 7	5	6
QFN	〃 (small type)		4			
QFP	Polypropylene		4	3		
QFS	Polystyrole	2	4	3		
QFZ	Special					

9.4.1

2nd letter First letter	A	B	C	D	E	F	G	H	J	K	V	W	X
0						3.15			6.3				
1	10		16	20	25		40	50	63		35		
2	100	125	160	200	250	315	400	500	630		350	450	600
3	1000	1250		2000				5000					

9.4.2 Tolerance

Symbol	F	G	J	K	M	Z	P	A	H	R
(%)	±1	±2	±5	±10	±20	+80 −20	+100 − 0	+100 − 10	+50 −10	+30 −10

9.4.3 Values

— Example — Values are in picofarads.

101 ..... 10 x 10^1..... 100 pF

102 ..... 10 x 10^2..... 1,000 pF

103 ..... 10 x 10^3..... 10,000 pF = 0.01 μF

104 ..... 10 x 10^4..... 100,000 pF = 0.1 μF

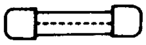
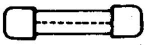
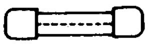
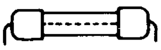
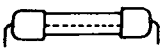
5R0 ..... 10 x 10^5..... 5 pF

9.5 FUSE CODING

Q M F 1 2 3 4 — 5 6 7

Q M F: COMMON SYMBOL

1 2: Shape of Fuse

Symbol No.	Shape	Remarks
51		φ 5.2 x 20
60		φ 6.4 x 30
61		φ 6.35 x 31.8
63		With 60 Lead Wire
66		With 61 Lead Wire

4: Rated Voltage

Symbol No.	Rated Voltage
1	AC 125 V
2	AC 250 V

5 6 7: Values

R10	0.1 A
R125	0.125 A
1R0	1.0 A
1R2	1.2 A
1R25	1.25 A
100	10 A

3: Characteristics

Symbol No.	Fusing current	Fusing time	Remarks
S	160%	Within 1 hr.	Anti-rush Type
	200%	″ 2 min.	
	700%–2000%	″ 0.01 sec.	
R	160%	″ 1 hr.	Regular Fusible Type
	200%	″ 2 min.	
M	135%	″ 1 hr.	Regular Fusible Type (for UL)
	200%	″ 2 min.	
U	135%	″ 1 hr.	Anti-rush Type (for UL)
	200%	″ 2 min.	
	800%–2000%	″ 0.01 sec.	
A	210%	″ 2 min.	Anti-rush Type (for Europe)
	275%	0.5 – 10 sec.	
	400%	0.15 – 2 sec.	
	1000%	0.02 – 0.3 sec.	
B	210%	Within 30 min.	Regular Fusible Type (for SEMKO, Europe)
	275%	0.05 – 2 sec.	
	400%	0.01 – 0.3 sec.	

9.6 ELECTRICAL PARTS LIST BY ASSEMBLIES

9.6.1 SERVO (1) CIRCUIT BOARD ASS'Y $\boxed{0}\boxed{1}$ PU49567A-M

Symbol No.	Part No.	Part Name	Description
IC 1	AN360	Integrated Circuit	
IC 2	BA222V	"	
IC 3	"	"	
IC 4	UPD4011C	"	
IC 5	MB84066BM	"	or MSM4066
IC 6	UPD4017C	"	
IC 7	UPC1458C	"	
IC 8	BA222V	"	
IC 9	UPD4027C	"	
IC10	BA664	"	
IC11	UPD4011C	"	
IC12	AN6341	"	
IC13	UPC1458C	"	
IC14	BA841A	"	or BA841
IC15	LM2907N-8	"	
IC16	BA222V	"	
IC17	UPD4069C	"	
X 1	2SD636R	Transistor	
X 2	"	"	
X 3	2SB643R	"	
X 4	"	"	
X 5	2SD636R	"	
X 6	"	"	
X 7	"	"	
X 8	2SB643R	"	
X 9	2SD636R	"	
X10	"	"	
X11	"	"	
X12	2SD636S, T	"	
X13	2SB643R	"	
X14	2SD636R	"	
X15	"	"	
X16	"	"	
X17	"	"	
X18	"	"	
X19	2SA885G	"	
X20	2SD636R	"	
X21	"	"	
X22	"	"	
X23	"	"	
X24	"	"	
D 1	—	—	
D 2	1S2473	Diode	
D 3	"	"	
D 4	"	"	
D 5	RD3.9EB	Zener Diode	
D 6	1S2473	Diode	
D 7	"	"	
D 8	"	"	
D 9	"	"	
D10	"	"	
D11	"	"	
D12	"	"	
D13	"	"	
D14	"	"	
D15	"	"	
D16	"	"	
D17	"	"	
D18	"	"	

Symbol No.	Part No.	Part Name	Description
D19	1S2473	Diode	
D20	"	"	
D21	"	"	
D22	VO3C	"	
D23	"	"	
D24	RD6.2EB	Zener Diode	
D25	1S2473	Diode	
D26	"	"	
D27	"	"	
D28	RD11EB	Zener Diode	
D29	1S2473	Diode	
D30	RD8.2EB	Zener Diode	
D31	1S2473	Diode	
D32	"	"	
D33	"	"	
D34	"	"	
D35	"	"	
R 1	QRD181J-221	CR	
R 2	" -221	"	
R 3	" -683	"	
R 4	" -224	"	
R 5	" -121	"	
R 6	—	—	
R 7	—	—	
R 8	QRD181J-103	CR	
R 9	" -222	"	
R10	" -393	"	
R11	" -103	"	
R12	" -222	"	
R13	" -103	"	
R14	" -274	"	
R15	" -103	"	
R16	" -683	"	
R17	" -473	"	
R18	" -184	"	
R19	" -124	"	
R20	" -104	"	
R21	" -473	"	
R22	" -103	"	
R23	" -683	"	
R24	" -333	"	
R25	" -103	"	
R26	" -273	"	
R27	" -103	"	
R28	" -153	"	
R29	—	—	
R30	—	—	
R31	—	—	
R32	QRD181J-473	CR	
R33	" -153	"	
R34	" -104	"	
R35	" -104	"	
R36	" -103	"	
R37	" -823	"	
R38	" -221	"	
R39	" -223	"	
R40	" -224	"	
R41	" -221	"	
R42	" -104	"	
R43	" -334	"	
R44	" -151	"	

Symbol No.	Part No.	Part Name	Description
R45	QRD181J-153	CR	
R46	" -153	"	
R47	" -153	"	
R48	" -153	"	
R49	" -222	"	
R50	" -223	"	
R51	" -394	"	
R52	" -563	"	
R53	" -103	"	
R54	" -223	"	
R55	" -224	"	
R56	" -103	"	
R57	" -472	"	
R58	" -223	"	
R59	" -682	"	
R60	" -103	"	
R61	" -473	"	
R62	" -473	"	
R63	" -393	"	
R64	" -473	"	
R65	" -104	"	
R66	QVP4A0B-224	VR	
R67	QRD181J-334	CR	
R68	" -473	"	
R69	" -104	"	
R70	" -223	"	
R71	" -224	"	
R72	QVZ3501-224	VR	
R73	QRD181J-104	CR	
R74	" -473	"	
R75	" -103	"	
R76	" -274	"	
R77	" -105	"	
R78	" -273	"	
R79	" -223	"	
R80	" -153	"	
R81	" -222	"	
R82	" -123	"	
R83	QVZ3501-473	VR	
R84	QRD181J-184	CR	
R85	" -474	"	
R86	QRV141F-9761	CMR	
R87	QRD181J-102	CR	
R88	" -183	"	
R89	" -472	"	
R90	" -472	"	
R91	" -684	"	
R92	" -104	"	
R93	" -473	"	
R94	" -393	"	
R95	" -683	"	
R96	" -103	"	
R97	" -103	"	
R98	" -562	"	
R99	" -103	"	
R100	" -562	"	
R101	" -104	"	
R102	" -102	"	
R103	" -101	"	
R104	" -473	"	
R105	" -103	"	
R106	" -103	"	
R107	" -473	"	

Symbol No.	Part No.	Part Name	Description
R108	QRD181J-104	CR	
R109	" -123	"	
R110	" -392	"	
R111	" -103	"	
R112	" -682	"	
R113	" -223	"	
R114	" -224	"	
R115	" -152	"	
R116	QVZ3501-104	VR	
R117	QRD181J-104	CR	
R118	" -104	"	
R119	" -473	"	
R120	" -103	"	
R121	" -224	"	
R122	" -103	"	
R123	" -103	"	
R124	" -104	"	
R125	" -472	"	
R126	" -472	"	
R127	" -152	"	
R128	" -154	"	
R129	QVP4A0B-334	VR	
R130	QRD181J-154	CR	
R131	" -472	"	
R132	QVZ3501-473	VR	
R133	QRD181J-472	CR	
R134	" -223	"	
R135	" -564	"	
R136	" -561	"	
R137	" -563	"	
R138	" -104	"	
R139	" -472	"	
R140	" -564	"	
R141	" -103	"	
R142	" -154	"	
R143	" -104	"	
R144	" -563	"	
R145	" -473	"	
R146	" -152	"	
R147	" -154	"	
R148	" -223	"	
R149	QVP4A0B-472	VR	
R150	QRD181J-103	CR	
R151	" -224	"	
R152	" -103	"	
R153	" -103	"	
R154	" -223	"	
R155	" -472	"	
R156	" -681	"	
R157	" -223	"	
R158	" -472	"	
R159	" -681	"	
R160	QRV141F-2103	CMR	
R161	QRD181J-103	CR	
R162	" -103	"	
R163	" -222	"	
R164	" -182	"	
R165	" -394	"	
R166	" -104	"	
R167	" -181	"	
R168	" -103	"	
R169	—	—	
R170	QRD181J-823	CR	

Symbol No.	Part No.	Part Name	Description
R171	QRD181J-103	CR	
R172	" -103	"	
R173	" -103	"	
C 1	QET61ER-475	E Cap	
C 2	QET61CR-227	"	
C 3	" -106	"	
C 4	QFN31HK-102	M Cap	
C 5	QCS31HJ-331	C Cap	
C 6	QET61HR-335	E Cap	
C 7	QFN31HK-104	M Cap	
C 8	" -103	"	
C 9	QET61CR-106	E Cap	
C10	QFP42AJ-363	PP Cap	
C11	QFN31HK-103	M Cap	
C12	QET61CR-106	E Cap	
C13	QFN31HK-102	M Cap	
C14	" -393	"	
C15	" -103	"	
C16	QET61CR-106	E Cap	
C17	—	—	
C18	QEN61CM-106	NP Cap	
C19	QET61CR-227	E Cap	
C20	QFN31HK-272	M Cap	
C21	QEN61CM-106	NP Cap	
C22	QET61CR-106	E Cap	
C23	QFN31HK-102	M Cap	
C24	QET61CR-227	E Cap	
C25	" -476	"	
C26	" -106	"	
C27	QFN31HK-683	M Cap	
C28	QET61CR-106	E Cap	
C29	QFN31HK-102	M Cap	
C30	QFP42AJ-563	PP Cap	
C31	" -274	"	
C32	QFN31HK-102	M Cap	
C33	" -104	"	
C34	QET61CR-476	E Cap	
C35	QFN31HJ-683	M Cap	
C36	QFP42AJ-683	PP Cap	
C37	QFN31HK-104	M Cap	
C38	QCF31HP-103	C Cap	
C39	QEE51CM-106	Tan Cap	
C40	" -106	"	
C41	" -226	"	
C42	" -226	"	
C43	QET61CR-227	E Cap	
C44	QET61ER-475	"	
C45	QET61CR-106	"	
C46	QFN31HK-103	M Cap	
C47	" -104	"	
C48	" -184	"	
C49	" -333	"	
C50	QFN31HJ-154	"	
C51	" -103	"	
C52	QET61CR-107	E Cap	
C53	" -106	"	
C54	QFN31HJ-104	M Cap	
C55	" -223	"	
C56	" -223	"	
C57	QEE51VM-474	Tan Cap	
C58	QET61ER-475	E Cap	

Symbol No.	Part No.	Part Name	Description
C59	QFN31HK-103	M Cap	
C60	QEN61CM-106	NP Cap	
C61	QFP42AG-203	PP Cap	
C62	QFN31HK-104	M Cap	
C63	QET61CR-106	E Cap	
C64	QFN31HK-103	M Cap	
C65	QET61HR-105	E Cap	
C66	QFN31HK-333	M Cap	
C67	" -154	"	
C68	QET61CR-476	E Cap	
C69	QFN31HK-102	M Cap	
C70	QET61ER-475	E Cap	
C71	QFN31HK-394	M Cap	
C72	" -222	"	
C73	QCF31HP-103	C Cap	
C74	" -103	"	
C75	QET61HR-107	E Cap	
C76	QFN31HK-184	M Cap	
L 1	A04725-220	Peaking Coil	
L 2	" -120	"	
	PU43351-2R	Cap Housing	(11–12)
	" -4R	"	(21–24)
	" -12	"	(31–42)
	" -14	"	(51–64)
	" -8	"	(71–78)
	" -2R	"	(81–82)
	" -4	"	(91–94)
	" -2	"	(101–102)
	" -2R	"	(111–112)
	" -2R	"	(121–122)
	A74138-1	Test Pin	TP1–TP17, TP19, TP20
	PU32565	Board Frame (C)	
	E48729-001	Plastic Rivet	

9.6.2 SERVO (2) CIRCUIT BOARD ASS'Y $\boxed{0}\boxed{2}$

.... PU49568A-M

Symbol No.	Part No.	Part Name	Description
IC 1	AN6342	Integrated Circuit	
IC 2	UPD4011C	"	
IC 3	AN6344	"	
IC 4	UPD4066	"	
IC 5	UPC1458C	"	
IC 6	"	"	
IC 7	BA222V	"	
X 1	2SD636R	Transistor	
X 2	"	"	
X 3	"	"	
X 4	PN202S	Photo Transistor	
X 5	2SD636R	Transistor	
X 6	"	"	
X 7	2SB643R	"	
X 8	2SD636R	"	
X 9	–	–	
X10	2SD636R	Transistor	
X11	"	"	
X12	"	"	
X13	2SC945Q, P, K	"	
X14	"	"	
X15	2SA733Q, P, K	"	
X16	"	"	
X17	2SA733Q	"	
X18	"	"	
X19	"	"	
X20	"	"	
X21	2SC945Q, P	"	
X22	"	"	
X23	"	"	
X24	"	"	
X25	"	"	
X26	"	"	
X27	"	"	
X28	"	"	
X29	2SC1983R	"	
X30	"	"	
X31	"	"	
X32	"	"	
X33	2SC2259G, F	"	
X34	2SD636R	"	
X35	"	"	
X36	"	"	
D 1	1S2473	Diode	
D 2	"	"	
D 3	"	"	
D 4	"	"	
D 5	"	"	
D 6	"	"	
D 7	"	"	
D 8	"	"	
D 9	"	"	
D10	"	"	
D11	–	–	
D12	–	–	
D13	–	–	
D14	1S2473	Diode	

Symbol No.	Part No.	Part Name	Description
R 1	QRD181J-474	CR	
R 2	" -223	"	
R 3	" -682	"	
⚠ R 4	QRG019J-181	OMR	
R 5	QRD181J-332	CR	
R 6	" -823	"	
R 7	" -822	"	
R 8	" -272	"	
R 9	" -271	"	
R10	" -103	"	
R11	" -472	"	
R12	" -152	"	
R13	" -101	"	
R14	" -563	"	
R15	" -563	"	
R16	" -103	"	
R17	" -103	"	
R18	" -821	"	
R19	" -472	"	
R20	" -562	"	
R21	" -682	"	
R22	" -473	"	
R23	QVZ3501-104	VR	
R24	QRD181J-274	CR	
R25	" -105	"	
R26	" -564	"	
R27	" -105	"	
R28	QVZ3501-473	VR	
R29	QRD181J-682	CR	
R30	QVZ3501-473	VR	
R31	QRD181J-682	CR	
R32	QVZ3501-224	VR	
R33	QRD181J-224	CR	
R34	" -103	"	
R35	" -103	"	
R36	" -101	"	
R37	QRV142F-4641	CMR	
R38	QRV141F-1503	"	
R39	QVZ3501-473	VR	
R40	QRD181J-103	CR	
R41	" -102	"	
R42	" -822	"	
R43	" -683	"	
R44	" -684	"	
R45	" -103	"	
R46	" -103	"	
R47	" -472	"	
R48	QVZ3501-222	VR	
R49	QRD181J-472	CR	
R50	" -682	"	
R51	QVZ3501-222	VR	
R52	QRD181J-272	CR	
R53	–	–	
R54	QRD181J-682	CR	
R55	" -562	"	
R56	" -473	"	
R57	" -473	"	
R58	" -223	"	
R59	" -122	"	
R60	" -822	"	
R61	" -104	"	
R62	" -223	"	
R63	" -224	"	

Symbol No.	Part No.	Part Name	Description
R64	QRD181J-103	CR	
R65	" -104	"	
R66	QVP4A0B-224	VR	
R67	QRD181J-223	CR	
R68	" -103	"	
R69	" -683	"	
R70	QVP4A0B-224	VR	
R71	QRD181J-124	CR	
R72	" -223	"	
R73	" -682	"	
R74	–	–	
R75	QRD181J-393	CR	
R76	" -123	"	
R77	–	–	
R78	QRD181J-222	CR	
R79	" -103	"	
R80	" -154	"	
R81	" -123	"	
R82	" -222	"	
R83	" -123	"	
R84	" -222	"	
R85	" -392	"	
R86	" -473	"	
R87	" -681	"	
R88	" -392	"	
R89	" -473	"	
R90	" -681	"	
R91	" -151	"	
R92	" -151	"	
R93	" -153	"	
R94	" -153	"	
R95	" -474	"	
R96	" -474	"	
R97	" -474	"	
R98	" -474	"	
R99	" -471	"	
R100	" -471	"	
R101	" -472	"	
R102	" -472	"	
R103	" -472	"	
R104	" -472	"	
R105	" -102	"	
R106	" -271	"	
R107	" -271	"	
R108	" -271	"	
R109	" -271	"	
R110	" -681	"	
⚠R111	QRX029J-R68	MFR	
R112	QRD181J-223	CR	
R113	" -103	"	
R114	" -152	"	
R115	" -181	"	
R116	" -681	"	
R117	" -562	"	
⚠R118	QRZ0054-4R7-BS	Fusible Resistor	
R119	QRD181J-473	CR	
R120	" -124	"	
R121	" -471	"	
R122	" -471	"	
R123	" -223	"	
R124	" -270	"	
R125	" -270	"	

Symbol No.	Part No.	Part Name	Description
C 1	QET61CR-106	E Cap	
C 2	QCS31HJ-150	C Cap	
C 3	" -101	"	
C 4	" -101	"	
C 5	QET61CR-107	E Cap	
C 6	QET61HR-105	"	
C 7	" -105	"	
C 8	" -105	"	
C 9	QET61CR-106	"	
C10	QFN31HJ-124	M Cap	
C11	QET61HR-105	E Cap	
C12	" -105	"	
C13	QFN31HJ-393	M Cap	
C14	" -393	"	
C15	" -223	"	
C16	QFN31HK-102	"	
C17	QFP42AJ-274	PP Cap	
C18	QFN31HK-104	M Cap	
C19	QET61CR-107	E Cap	
C20	QFN31HK-104	M Cap	
C21	QFP42AJ-243	PP Cap	
C22	QFN31HJ-123	M Cap	
C23	–	–	
C24	QEE51CM-106	Tan Cap	
C25	QET61CR-106	E Cap	
C26	" -106	"	
C27	QFN31HJ-104	M Cap	
C28	QFN31HK-473	"	
C29	" -682	"	
C30	" -392	"	
C31	" -103	"	
C32	QET61CR-337	E Cap	
C33	QFN31HK-104	M Cap	
C34	QEE51VM-684	Tan Cap	
C35	–	–	
C36	QET61HR-475	E Cap	
C37	" -475	"	
C38	QFN31HJ-103	M Cap	
C39	" -103	"	
C40	QET61CR-227	E Cap	
C41	QEN61CM-475	NP Cap	
C42	" -475	"	
C43	QET61HR-105	E Cap	
C44	QFN31HK-102	M Cap	
C45	QET61HR-335	E Cap	
C46	" -335	"	
C47	QET61CR-227	"	
C48	QCF31HP-103	C Cap	
C49	" -103	"	
C50	QCS31HJ-101	"	
C51	QFN31HK-102	M Cap	
C52	QCF31HP-223	C Cap	
C53	" -103	"	
C54	" -103	"	
L 1	A04725-270	Peaking Coil	
X'TAL	PU31449-2	Crystal	
LPF 1	PU47681	Low Pass Filter	
	PU43351-104R	Cap Housing	(11–14)

Symbol No.	Part No.	Part Name	Description
	PU43351-105R	Cap Housing	(21–25)
	〃 -112	〃	(31–42)
	〃 -109	〃	(51–59)
	〃 -114	〃	(61–74)
	〃 -102R	〃	(81–82)
	〃 -102R	〃	(91–92)
	PU49467	Shade	
	A74138-1	Test Pin	TP1–14

9.6.3 Y/COLOUR CIRCUIT BOARD ASS'Y 0 3

. . . . PU49460A-M(EG)
. . . . PU49460B-M(EK)

Symbol No.	Part No.	Part Name	Description
IC 1	HA11701	Integrated Circuit	
IC 2	10VT01	〃	
IC 3	9VT01	〃	
IC 4	HA11703	〃	
IC 5	9V107	〃	
IC 6	UPC577H	〃	
IC 7	VC2011	〃	or VC2011M
IC201	HA11710	Integrated Circuit	
IC202	HA11717	〃	
IC203	HA11706	〃	
IC204	BA401	〃	EG only
IC205	21VT02	〃	EG only
IC206	HA11706	〃	
X 1	2SC2063P, Q	Transistor	
X 2	2SC2063Q, R	〃	
X 3	〃	〃	
X 4	2SC2063P, Q	〃	
X 5	〃	〃	
X 6	–	–	
X 7	2SA786Q	Transistor	
X 8	2SC2063Q	〃	
X 9	〃	〃	
X10	2SC2063P, Q	〃	
X11	2SC2063Q, R	〃	
X12	2SC2063P, Q	〃	
X13	2SA786Q	〃	
X201	2SC2063P, Q	Transistor	
X202	2SA786Q	〃	
X203	〃	〃	
X204	2SC2063Q, R	〃	EG only
X205	–	–	
X206	2SC2063Q, R	Transistor	
X207	2SC2063Q	〃	
X208	2SC2063Q, R	〃	
X209	2SC1652Q	〃	EG only
D 1	1S2473	Diode	
D 2	〃	〃	
D 3	–	–	
D 4	–	–	
D 5	OA90	Diode	
D 6	〃	〃	
D 7	WO3C	〃	
D 8	1S2473	〃	
D201	1S2473	Diode	
D202	〃	〃	EG only
D203	–	–	
D204	1S2473	Diode	EG only
D205	OA90	〃	
D206	1S2473	〃	
D207	〃	〃	EG only
D208	RD3.6EB	Zener Diode	
D209	1S2473	Diode	EG only
D210	〃	〃	
D211	〃	〃	

Symbol No.	Part No.	Part Name	Description
R 1	QRD181J-222	CR	
R 2	″ -182	″	
R 3	″ -222	″	
R 4	—	—	
R 5	QRD181J-124	CR	
R 6	″ -333	″	
R 7	″ -102	″	
R 8	—	—	
R 9	QRD181J-103	CR	
R10	QVP4A0B-472	VR	
R11	″ -103	″	
R12	QRD181J-103	CR	
R13	″ -223	″	
R14	″ -472	″	
R15	″ -332	″	
R16	″ -471	″	
R17	QVP4A0B-223	VR	
R18	″ -223	″	
R19	″ -223	″	
R20	QRD181J-471	CR	
R21	″ -102	″	
R22	″ -471	″	
R23	″ -472	″	
R24	″ -472	″	
R25	″ -682	″	
R26	″ -224	″	
R27	″ -682	″	
R28	″ -822	″	
R29	″ -473	″	
R30	″ -682	″	
R31	″ -682	″	
R32	″ -683	″	
R33	″ -682	″	
R34	″ -222	″	
R35	″ -152	″	
R36	QVP4A0B-102	VR	
R37	QRD181J-221	CR	
R38	″ -391	″	
R39	—	—	
R40	QRD181J-221	CR	
R41	″ -181	″	
R42	″ -271	″	
R43	—	—	
R44	—	—	
R45	—	—	
R46	QRD181J-221	CR	
R47	″ -272	″	
R48	″ -273	″	
R49	″ -183	″	
R50	″ -391	″	
R51	″ -104	″	
R52	″ -182	″	
R53	″ -151	″	
R54	QVP4A0B-221	VR	
R55	QRD181J-152	CR	
R56	″ -331	″	
R57	″ -561	″	
R58	″ -561	″	
R59	—	—	
R60	QRD181J-471	CR	
R61	QVP4A0B-102	VR	
R62	QRD181J-561	CR	
R63	″ -102	″	

Symbol No.	Part No.	Part Name	Description
R64	QRD181J-223	CR	
R65	″ -102	″	
R66	″ -561	″	
R67	″ -102	″	
R68	″ -391	″	
R69	″ -123	″	
R70	″ -122	″	
R71	″ -102	″	
R72	″ -122	″	
R73	″ -222	″	
R74	″ -222	″	
R75	QVP4A0B-103	VR	
R76	QRD181J-154	CR	
R77	″ -104	″	
R78	″ -122	″	
R79	″ -184	″	
R80	″ -561	″	
R81	″ -683	″	
R82	″ -152	″	
R83	″ -103	″	
R84	″ -332	″	
R85	″ -392	″	
R86	QVP4A0B-102	VR	
R87	QRD181J-101	CR	
R88	″ -102	″	
R89	″ -392	″	
R90	QVP4A0B-223	VR	
R91	QRD181J-153	CR	
R92	″ -222	″	
R93	″ -331	″	
R94	″ -222	″	
R95	″ -221	″	
R96	″ -273	″	
R97	″ -562	″	
R98	″ -102	″	
R99	″ -272	″	
R201	QRD181J-102	CR	
R202	″ -102	″	
R203	″ -102	″	
R204	″ -821	″	
R205	″ -102	″	
R206	″ -681	″	
R207	″ -102	″	
R208	″ -824	″	
R209	″ -392	″	
R210	QVP4A0B-103	VR	
R211	ERT-D2FHK-153S	Thermister	
R212	QRD181J-224	CR	
R213	″ -333	″	
R214	″ -183	″	
R215	″ -102	″	
R216	″ -332	″	
R217	″ -272	″	
R218	″ -102	″	
R219	″ -562	″	
R220	″ -103	″	
R221	″ -393	″	
R222	″ -151	″	
R223	″ -102	″	
R224	QVP4A0B-471	VR	
R225	QRD181J-122	CR	
R226	″ -391	″	

Symbol No.	Part No.	Part Name	Description
R227	QRD181J-391	CR	
R228	" -391	"	
R229	" -391	"	
R230	" -391	"	
R231	" -153	"	EG only
R232	–	–	
R233	QRD181J-223	CR	EG only
R234	" -333	"	
R235	" -101	"	
R236	–	–	
R237	QRD181J-472	CR	
R238	" -472	"	
R239	" -102	"	
R240	QVP4A0B-103	VR	
R241	QRD181J-392	CR	
R242	" -821	"	
R243	" -472	"	
R244	" -222	"	
R245	" -222	"	
R246	" -332	"	
R247	" -102	"	
R248	" -472	"	
R249	" -102	"	
R250	" -271	"	
R251	" -102	"	
R252	QRD121J-471	"	
R253	QRD181J-682	"	
R254	" -102	"	
R255	" -103	"	
R256	" -473	"	
R257	" -222	"	EG only
R258	" -472	"	
R259	" -103	"	EG only
R260	" -682	"	
R261	" -561	"	
R262	" -332	"	
R263	" -102	"	
R264	" -332	"	
R265	" -222	"	
R266	QVP4A0B-103	VR	
R267	QRD181J-104	CR	
R268	" -153	"	
R269	" -474	"	
R270	" -564	"	
R271	" -272	"	
R272	" -152	"	
R273	" -561	"	
R274	" -472	"	
R275	" -472	"	
R276	" -222	"	
R277	" -123	"	
R278	QVP4A0B-332	VR	
R279	QRD181J-183	CR	
R280	" -561	"	
R281	" -222	"	
R282	" -103	"	
R283	" -223	"	
R284	QVP4A0B-471	VR	EG only
R285	QRD181J-102	CR	EG only
R286	" -682	"	EG only
R287	" -331	"	EG only
R288	ERT-D2FGL-601S	Thermistor	EG only
R289	QRD181J-561	CR	EG only

Symbol No.	Part No.	Part Name	Description
R290	–	–	
R291	–	–	
R292	QRD181J-473	CR	EG only
R293	" -272	"	EG only
R294	" -272	"	
R295	" -474	"	
R296	" -104	"	
R297	" -153	"	
R298	QVP4A0B-103	VR	
R299	QRD181J-564	CR	
R300	" -682	"	
R301	" -561	"	
R302	" -561	"	
R303	" -222	"	
R304	" -331	"	
R305	" -102	"	
R306	–	–	
R307	QRD181J-272	CR	EG only
C 1	QFN31HK-103	M Cap	
C 2	–	–	
C 3	–	–	
C 4	QCF31HP-223	C Cap	
C 5	" -223	"	
C 6	QET61CR-107	E Cap	
C 7	QCF31HP-223	C Cap	
C 8	QCS31HJ-121	"	
C 9	QCF31HP-223	"	
C10	QET61CR-336	E Cap	
C11	QCF31HP-223	C Cap	
C12	QCS31HJ-820	"	
C13	QET61HR-105	E Cap	
C14	QCS31HJ-561	C Cap	
C15	QET61CR-107	E Cap	
C16	QCS31HJ-101	C Cap	
C17	QCF31HP-223	"	
C18	QCS31HJ-101	"	
C19	QET61CR-106	E Cap	
C20	QFN31HK-392	M Cap	
C21	QET61CR-336	E Cap	
C22	QFN31HK-104	M Cap	
C23	QET60JR-476	E Cap	
C24	QET61CR-476	"	
C25	QET61AR-476	"	
C26	–	–	
C27	–	–	
C28	QCF31HP-223	C Cap	
C29	QET61CR-336	E Cap	
C30	" -336	"	
C31	" -476	"	
C32	QCF31HP-473	C Cap	
C33	" -223	"	
C34	QET61CR-476	E Cap	
C35	" -336	"	
C36	QCS31HJ-151	C Cap	
C37	QFN31HJ-102	M Cap	
C38	QET61CR-476	E Cap	
C39	QCS31HJ-151	C Cap	
C40	" -221	"	
C41	" -680	"	
C42	QET61CR-336	E Cap	
C43	" -336	"	

Symbol No.	Part No.	Part Name	Description
C44	QET61CR-336	E Cap	
C45	QCF31HP-223	C Cap	
C46	QCS31HJ-101	"	
C47	QET61CR-107	E Cap	
C48	" -106	"	
C49	QCF31HP-223	C Cap	
C50	QCS31HJ-181	"	
C51	" -180	"	
C52	" -121	"	
C53	" -180	"	
C54	QET61CR-107	E Cap	
C55	QET61ER-475	"	
C56	QFN31HK-103	M Cap	
C57	QCF31HP-473	C Cap	
C58	QCS31HJ-301	"	
C59	" -680	"	
C60	QET61CR-476	E Cap	
C61	" -106	"	
C62	QCF31HP-223	C Cap	
C63	—	—	
C64	QFN31HK-103	M Cap	
C65	QCS31HJ-220	C Cap	
C66	QET61CR-336	E Cap	
C67	QFN31HK-103	M Cap	
C68	QCF31HP-223	C Cap	
C69	" -223	"	
C70	" -223	"	
C71	" -223	"	
C72	QFN31HK-103	M Cap	
C73	QET61CR-336	E Cap	
C74	QCF31HP-223	C Cap	
C75	QFN31HK-103	M Cap	
C76	QFN31HK-103	"	
C77	QET61HR-105	E Cap	
C78	QCS31HJ-330	C Cap	
C79	QCS11HJ-181	"	
C201	QFN31HK-223	M Cap	
C202	" -333	"	
C203	" -333	"	
C204	" -223	"	
C205	QET61CR-476	E Cap	
C206	QFN31HK-333	M Cap	
C207	" -103	"	
C208	QCF31HP-223	C Cap	
C209	" -223	"	
C210	QFN31HK-333	M Cap	
C211	QCS31HJ-101	C Cap	
C212	QFN31HK-103	M Cap	
C213	QCS31HJ-151	C Cap	
C214	QFN31HK-152	M Cap	
C215	" -474	"	
C216	QCF31HP-223	C Cap	
C217	QCS31HJ-471	"	
C218	QFN31HK-103	M Cap	
C219	" -103	"	
C220	" -103	"	
C221	" -103	"	
C222	QET61CR-336	E Cap	
C223	QFN31HK-103	M Cap	
C224	" -103	"	
C225	" -103	"	
C226	QET61CR-106	E Cap	

Symbol No.	Part No.	Part Name	Description
C227	QFN31HK-102	M Cap	
C228	QCF31HP-223	C Cap	
C229	QET61CR-476	E Cap	
C230	QET61HR-105	"	
C231	QCS31HJ-101	C Cap	
C232	" -391	"	
C233	QFN31HK-333	M Cap	
C234	QET61HR-105	E Cap	
C235	QFN31HK-683	M Cap	
C236	" -103	"	
C237	" -183	"	
C238	QET61HR-105	E Cap	
C239	QCS31HJ-100	C Cap	
C240	" -5R0	"	
C241	QAT3001-008	Trimmer Cap	
C242	QET61CR-336	E Cap	
C243	QFN31HK-103	M Cap	
C244	QCF31HP-223	C Cap	
C245	" -223	"	EG only
C246	QET61CR-476	E Cap	
C247	QCT05CH-330	C Cap	
C248	" -390	"	
C249	QCF31HP-223	"	
C250	" -223	"	
C251	QFN31HK-102	M Cap	
C252	" -563	"	
C253	QCS31HJ-561	C Cap	
C254	QET61HR-105	E Cap	
C255	QFN31HK-333	M Cap	
C256	" -102	"	
C257	" -103	"	
C258	" -224	"	
C259	QCT05CH-820	C Cap	
C260	QCS31HJ-101	"	
C261	" -820	"	
C262	QFN31HK-102	M Cap	
C263	" -102	"	
C264	" -103	"	
C265	QCS31HJ-271	C Cap	
C266	QFN31HK-103	M Cap	
C267	" -103	"	EG only
C268	QCF31HP-223	C Cap	EG only
C269	QFN31HK-103	M Cap	EG only
C270	QET61CR-336	E Cap	EG only
C271	QCF31HP-223	C Cap	EG only
C272	QCT05LH-331	"	EG only
C273	QCS31HJ-221	"	EG only
C274	QFN31HK-223	M Cap	EG only
C275	QET61HR-105	E Cap	EG only
C276	QFN31HK-104	M Cap	EG only
C277	QET61ER-475	E Cap	EG only
C278	QET61CR-476	"	EG only
C279	QCF31HP-223	C Cap	EG only
C280	QCS31HJ-561	"	
C281	QET61CR-476	E Cap	
C282	QCF31HP-223	C Cap	
C283	QCS31HJ-560	"	
C284	" -150	"	
C285	QFN31HK-333	M Cap	
C286	" -223	"	
C287	QCS31HJ-121	C Cap	
C288	QFN31HK-102	M Cap	
C289	QCS31HJ-271	C Cap	

Symbol No.	Part No.	Part Name	Description
C290	QCF31HP-223	C Cap	
C291	–	–	
C292	QCS31HJ-100	C Cap	
L 1	A04725-100	Peaking Coil	
L 2	PU46021-101	Choke Coil	
L 3	" -101	"	
L 4	PU47051-332	Coil	
L 5	" -222	"	
L 6	–	–	
L 7	PU46021-101	Choke Coil	
L 8	A04725-18	Peaking Coil	
L 9	PU46003-6R8	"	
L10	PU46021-101	Choke Coil	
L11	A04725-18	Peaking Coil	
L12	PU46021-101	Choke Coil	
L13	A04725-330	Peaking Coil	
L14	PU46021-101	Choke Coil	
L15	A04725-18	Peaking Coil	
L16	" -100	"	
L201	PU46021-101	Choke Coil	
L202	" -101	"	
L203	PU46398-2	Coil	
L204	PU46003-6R8	"	
L205	PU47051-153	Choke Coil	
L206	PU46021-101	"	
L207	" -101	"	
L208	PU47051-822	Coil	
L209	A04725-100	Peaking Coil	EG only
L210	PU46398	Coil	EG only
L211	A04725-15	Peaking Coil	EG only
L212	PU47051-183	Coil	EG only
L213	PU47051-102	"	EG only
L214	PU49057	fH/2 Trap	EG only
L215	PU46021-101	Choke Coil	EG only
L216	" -101	"	
LC 1	PU49686	Trap	
LPF 1	PU49462	Low Pass Filter	
LPF 2	"	"	
LPF201	PU49464	Low Pass Filter	
BPF201	PU32489	Band Pass Filter	
BPF202	"	"	
BPF203	PU49465	"	
HPF 1	PU49962	High Pass Filter	
EQ-1	PU48519-2	Equalizer	
EQ-2	" -2	"	
DL201	PU46321-4M	2H Delay Line	
X'tal 201	PU31449-2	Crystal	
X'tal 202	PU46040	"	
X'tal 203	PU31449-2	"	
	PU43351-4	Cap Housing	(11–14)

Symbol No.	Part No.	Part Name	Description
	PU43351-6Y	Cap Housing	(21–26)
	" -2Y	"	(31–32)
	" -2	"	(41–42)
	" -2Y	"	(51–52)
	" -2R	"	(61–62)
	" -2	"	(71–72)
	" -2	"	(81–82)
	A74138-1	Test Pin	TP1–TP7, TP201–TP212
	PU32563	Board Frame (A)	
	PU32564	" (B)	
	PU49637	Shield Case	
	PU49638	"	
	PU49639	"	
	PU49640	"	
	E48729-001	Plastic Rivet	

9.6.4 PRE & REC CIRCUIT BOARD ASS'Y 0 4 ....PU49459A-M

Symbol No.	Part No.	Part Name	Description
IC 1	6A753	Integrated Circuit	
IC 2	"	"	
IC 3	HA11718	"	
X 1	2SD638Q, R, S	Transistor	
X 2	"	"	
X 3	2SC828Q, R, S	"	
X 4	"	"	
X 5	2SC2063P, Q	"	
X 6	2SC2063Q, R	"	
X 7	"	"	
X 8	2SA786Q	"	
X 9	2SA719R	"	
X10	2SC1317R	"	
X11	"	"	
X12	2SA719R	"	
X13	2SC2063P,Q	"	
X14	"	"	
X15	"	"	
D 1	1S2473	Diode	
D 2	"	"	
R 1	QRD181J-272	CR	
R 2	" -272	"	
R 3	" -3R9	"	
R 4	" -3R9	"	
R 5	" -272	"	
R 6	" -272	"	
R 7	" -391	"	
R 8	QVP4A0B-103	VR	
R 9	" -103	"	
R10	QRD181J-391	CR	
R11	" -561	"	
R12	" -561	"	
R13	" -272	"	
R14	" -392	"	
R15	" -103	"	
R16	" -152	"	
R17	" -473	"	
R18	–	–	
R19	QRD181J-392	CR	
R20	" -392	"	
R21	" -471	"	
R22	" -222	"	
R23	" -391	"	
R24	" -222	"	
R25	" -102	"	
R26	" -102	"	
R27	" -222	"	
R28	" -470	"	
R29	QVP4A0B-101	VR	
R30	" -102	"	
R31	QRD181J-152	CR	
R32	QVP4A0B-102	VR	
R33	QRD181J-222	CR	
R34	" -682	"	
R35	" -223	"	
R36	" -223	"	
R37	" -273	"	
R38	QRD181J-822	CR	
R39	" -561	"	
R40	" -220	"	
R41	" -102	"	
R42	" -102	"	
R43	" -562	"	
R44	" -562	"	
R45	" -102	"	
⚠ R46	QRG129J-100	OMR	
R47	QRD181J-100	CR	
⚠ R48	" -4R7A	"	
⚠ R49	" -4R7A	"	
R50	" -180	"	
R51	" -562	"	
R52	" -682	"	
R53	" -102	"	
R54	" -222	"	
R55	" -182	"	
R56	QVP4A0B-222	VR	
R57	QRD181J-104	CR	
R58	" -221	"	
R59	QRD187J-332	"	
R60	QRD181J-101	"	
R61	" -102	"	
R62	" -102	"	
C 1	QEC81CM-106	E Cap	
C 2	" -106	"	
C 3	QCF31HP-223	C Cap	
C 4	" -223	"	
C 5	" -223	"	
C 6	" -223	"	
C 7	QCS31HJ-150	"	
C 8	" -150	"	
C 9	QAT3001-009	Trimmer Cap	
C10	" -009	"	
C11	QFN31HK-223	M Cap	
C12	" -223	"	
C13	" -223	"	
C14	QCF31HP-223	C Cap	
C15	" -223	"	
C16	QFN31HK-223	M Cap	
C17	QCF31HP-223	C Cap	
C18	QET61CR-336	E Cap	
C19	" -336	"	
C20	QET61CR-106	"	
C21	QCF31HP-223	C Cap	
C22	" -223	"	
C23	QCS31HJ-101	"	
C24	QFN31HK-103	M Cap	
C25	QFT61HR-105	E Cap	
C26	QCS31HJ-151	C Cap	
C27	" -270	"	
C28	QFN31HK-103	M Cap	
C29	QET61CR-476	E Cap	
C30	QFN31HK-103	M Cap	
C31	QCF31HP-223	C Cap	
C32	" -223	"	
C33	QFN31HK-103	M Cap	
C34	QET61CR-476	E Cap	
C35	QCF31HP-223	C Cap	
C36	QFN31HK-223	M Cap	

Symbol No.	Part No.	Part Name	Description
C37	QFN31HK-223	M Cap	
C38	" -333	"	
C39	" -333	"	
C40	QCS31HJ-100	C Cap	
C41	QFN31HK-392	M Cap	
C42	" -223	"	
C43	" -563	"	
C44	QET61CR-476	E Cap	
C45	QFN31HK-223	M Cap	
C46	" -223	"	
C47	" -123	"	
C48	QCS31HJ-120	C Cap	
C49	QCF31HP-223	"	
C50	QET61HR-105	E Cap	
C51	QFN31HK-223	M Cap	
C52	–	–	
C53	QCF31HP-223	C Cap	
L 1	A04725-56	Peaking Coil	
L 2	" -56	"	
L 3	" -68	"	
L 4	" -8.2	"	
L 5	PU46021-101	Choke Coil	
L 6	A04725-8.2	Peaking Coil	
L 7	" -56	"	
L 8	" -100	"	
L 9	" -820	"	
L10	PU47051-822	Coil	
L11	A04725-82	Peaking Coil	
L12	PU46021-101	Choke Coil	
LPF 1	PU49464	Low Pass Filter	
HPF 1	PU49463	High Pass Filter	
DL 1	PU49466-2	1H Delay Line	
	PU43092	Collar	for R48, 49
	PU49218-6	Cap Housing	(11–16)
	PU43351-4	"	(21–24)
	" -2Y	"	(31–32)
	" -6	"	(41–46)
	" -4	"	(51–54)
	PU45908	Test Pin	TP1–TP4
	A74138-1	"	TP5–TP8
	PU32573	Shield Case	
	PU32574	"	
	PU32575	"	

9.6.5 AUDIO CIRCUIT BOARD ASS'Y 0 5
. . . . . PU49489A-M

Symbol No.	Part No.	Part Name	Description
IC 1	HA12005	Integrated Circuit	
IC 2	NJM4560D	"	
IC 3	BA222V	"	
IC 4	MN3010	"	
IC 5	UPD4066C	"	or MSM4066
IC 6	MSM4069	"	
IC 7	UPD4040C	"	or MSM4040C
IC 8	UPD4066C	"	or MSM4066
IC 9	LM1011N	"	
X 1	2SD661S	Transistor	
X 2	2SD636RS	"	
X 3	2SB641RS	"	
X 4	2SD636RS	"	
X 5	2SD661S	"	
X 6	–	–	
X 7	2SD636RS	Transistor	
X 8	2SD958TU	"	
X 9	"	"	
X10	2SD661TU	"	
X11	2SB788TU	"	
X12	2SD661S	"	
X13	"	"	
X14	2SB644RS	"	
X15	2SD639RS	"	
X16	2SD636RS	"	
X17	2SD639S	"	
X18	"	"	
X19	"	"	
X20	2SB644RS	"	
X21	2SD636RS	"	
X22	"	"	
X23	"	"	
X24	2SB641RS	"	
X25	2SD636RS	"	
D 1	1S2473	Diode	
D 2	"	"	
D 3	"	"	
D 4	–	–	
D 5	RD6.8EB	Zener Diode	
D 6	"	"	
D 7	"	"	
D 8	1S2473	Diode	
D 9	RD3.9EB	Zener Diode	
D10	HZ15-3	"	
D11	RD9.1EB3	"	
D12	1S2473	Diode	
D13	"	"	
D14	"	"	
D15	WO3C	"	
D16	1S2473	"	
D17	"	"	
D18	"	"	
R 1	QRD187J-823	CR	
R 2	QRD181J-103	"	
R 3	QVP4A0B-473	VR	
R 4	QRD181J-682	CR	
R 5	" -333	"	
R 6	" -125	"	
R 7	" -272	"	
R 8	" -125	"	

Symbol No.	Part No.	Part Name	Description
R 9	QRD181J-153	CR	
R10	〃 -103	〃	
R11	〃 -102	〃	
R12	–	–	
R13	QRD181J-473	CR	
R14	〃 -682	〃	
R15	〃 -332	〃	
R16	〃 -332	〃	
R17	〃 -104	〃	
R18	〃 -183	〃	
R19	〃 -682	〃	
R20	〃 -154	〃	
R21	〃 -153	〃	
R22	〃 -153	〃	
R23	〃 -271	〃	
R24	〃 -331		
R25	〃 -124		
R26	〃 -392		
R27	〃 -472		
R28	〃 -182		
R29	–	–	
R30	QRD181J-472	CR	
R31	QVP4A0B-473	VR	
R32	QRD181J-183	CR	
R33	〃 -333	〃	
R34	〃 -333	〃	
⚠ R35	QRZ0054-330-BS	Fusible Resistor	
R36	QRD181J-101	CR	
R37	〃 -104	〃	
R38	〃 -103	〃	
R39	〃 -102	〃	
R40	〃 -104	〃	
R41	〃 -392	〃	
R42	〃 -183	〃	
R43	〃 -472	〃	
R44	〃 -472	〃	
R45	QVP4A0B-223	VR	
R46	QRD181J-104	CR	
R47	〃 -183	〃	
R48	〃 -472	〃	
R49	QVP9A0B-681	VR	
R50	QRD181J-331	CR	
R51	〃 -100	〃	
R52	〃 -821	〃	
R53	〃 -223	〃	
R54	–	–	
R55	QRD181J-331	CR	
R56	〃 -151	〃	
R57	〃 -103	〃	
R58	〃 -183	〃	
R59	〃 -223	〃	
R60	〃 -472	〃	
R61	〃 -222	〃	
R62	〃 -472	〃	
R63	〃 -223	〃	
R64	QRD187J-472	〃	
R65	QRD181J-103	〃	
R66	〃 -332	〃	
R67	〃 -333	〃	
R68	QRD121J-331	〃	
R69	QRD187J-103	〃	
R70	QVP4A0B-224	VR	
R71	QRD181J-102	CR	
R72	QRD181J-102	CR	
⚠ R73	QRG129J-150	OMR	
⚠ R74	〃 -150	〃	
R75	QRD181J-222	CR	
R76	〃 -103	〃	
R77	〃 -103	〃	
R78	〃 -223	〃	
R79	〃 -822	〃	
⚠ R80	QRG026J-680	OMR	
R81	QRD181J-152	CR	
R82	〃 -821	〃	
⚠ R83	QRG026J-560	OMR	
R84	QRD181J-821	CR	
R85	〃 -103	〃	
R86	〃 -274	〃	
⚠ R87	QRG019J-102	OMR	
R88	QRD181J-104	CR	
R89	〃 -104	〃	
R90	〃 -122	〃	
R91	〃 -681	〃	
R92	〃 -561	〃	
R93	〃 -104	〃	
R94	QVP4A0B-103	VR	
R95	QRD181J-153	CR	
R96	〃 -152	〃	
R97	QVP4A0B-103	VR	
R98	〃 -103	〃	
R99	QRD181J-123	CR	
R100	QVP4A0B-683	VR	
R101	QRD181J-123	CR	
R102	〃 -103	〃	
R103	〃 -153	〃	
R104	QRD187J-104	〃	
R105	QRD181J-393	〃	
R106	〃 -224	〃	
R107	〃 -103	〃	
R108	〃 -473	〃	
R109	〃 -472	〃	
R110	〃 -472	〃	
R111	〃 -472	〃	
R112	〃 -124	〃	
R113	〃 -333	〃	
R114	〃 -224	〃	
R115	QVP4A0B-473	VR	
R116	QRD121J-471	CR	
R117	QRD181J-823	〃	
R118	〃 -273	〃	
R119	PU49341	VR	
R120	QRD181J-104	CR	
R121	〃 -181	〃	
R122	〃 -473	〃	
R123	〃 -332	〃	
R124	〃 -152	〃	
R125	〃 -274	〃	
R126	〃 -564	〃	
R127	〃 -274	〃	
R128	〃 -274	〃	
R129	〃 -103	〃	
R130	〃 -333	〃	
R131	〃 -103	〃	
R132	〃 -103	〃	
R133	〃 -473	〃	
R134	〃 -222	〃	

Symbol No.	Part No.	Part Name	Description
C 1	QET61ER-475	E Cap	
C 2	QET61CR-106	"	
C 3	QFN31HK-103	M Cap	
C 4	QET61AR-476	E Cap	
C 5	QFN41HK-222	M Cap	
C 6	QET61HR-474	E Cap	
C 7	QET60JR-107	"	
C 8	QET61HR-474	"	
C 9	QET61CR-226	"	
C10	QEE41CM-475	T Cap	
C11	QFN31HK-392	M Cap	
C12	QCS31HJ-821	C Cap	
C13	QET61ER-475	E Cap	
C14	QFN31HK-102	M Cap	
C15	" -102	"	
C16	" -273	"	
C17	" -102	"	
C18	QET61CR-106	E Cap	
C19	QET61ER-475	"	
C20	QFN31HK-102	M Cap	
C21	QCS31HJ-101	C Cap	
C22	–	–	
C23	QCS31HJ-681	C Cap	
C24	QET61CR-227	E Cap	
C25	QET61ER-335	"	
C26	" -475	"	
C27	QET61HR-105	"	
C28	QET61CR-106	"	
C29	QET61ER-475	"	
C30	QET61CR-476	"	
C31	" -106	"	
C32	QET61ER-475	"	
C33	QFN31HK-222	M Cap	
C34	" -393	"	
C35	QET61HR-105	E Cap	
C36	QCS31HJ-271	C Cap	
C37	QET61ER-475	E Cap	
C38	QCS31HJ-561	C Cap	
C39	QFN31HK-102	M Cap	
C40	QET61CR-107	E Cap	
C41	QCS31HJ-561	C Cap	
C42	QFP32XK-392	PP Cap	
C43	" -272	"	
C44	–	–	
C45	QET61VR-476	"	
C46	QET61ER-106	"	
C47	QFN31HK-104	M Cap	
C48	QET61CR-476	E Cap	
C49	" -107	"	
C50	QFN31HK-103	M Cap	
C51	" -103	"	
C52	" -153	"	
C53	QET61CR-476	E Cap	
C54	QFN31HK-222	M Cap	
C55	QET61CR-336	E Cap	
C56	QFN31HK-123	M Cap	
C57	" -124	"	
C58	" -123	"	
C59	QET61HR-105	E Cap	
C60	QET61CR-106	"	
C61	QET61HR-105	"	
C62	QFN31HK-472	M Cap	
C63	QCS31HJ-561	C Cap	
C64	QET61CR-106	E Cap	
C65	" -107	"	
C66	QCS31HJ-181	C Cap	
C67	QET61CR-107	E Cap	
C68	–	–	
C69	QFN31HK-103	M Cap	
C70	QEN61CM-475	NP Cap	
C71	" -475	"	
C72	QFN31HK-562	M Cap	
C73	QET61CR-106	E Cap	
C74	QFN31HK-273	M Cap	
C75	" -472	"	
C76	" -472	"	
C77	QET61CR-227	E Cap	
C78	QFN31HK-392	M Cap	
C79	" -562	"	
C80	" -273	"	
C81	QET61CR-106	E Cap	
C82	QFN31HK-823	M Cap	
C83	QEE41VM-334	Tan Cap	
C84	QFN31HK-104	M Cap	
C85	QET61CR-106	E Cap	
C86	QFN31HK-473	M Cap	
C87	QCF11HP-223	C Cap	
L 1	PU30284-25N	Peaking Coil	
L 2	T40442-001	"	
L 3	PU40010-102	"	
L 4	A04725-8200	"	
L 5	" -1000	"	
L 6	T40442-001	"	
L 7	" -001	"	
T 1	PU30961	Transformer	
RY 1	PU46682	Relay	
	PU43351-2Y	Cap Housing	(11–12)
	-2R	"	(21–22)
	-8	"	(31–38)
	-4	"	(41–44)
	-4Y	"	(51–54)
	-3R	"	(61–63)
	-3Y	"	(71–73)
	-2R	"	(81–82)
	-2	"	(91–92)
	A74138-1	Test Pin	(TP1–TP10)
	PU32567	Board Frame (E)	
	PU43092-2	Collar	for R80, R83
	E48729-001	Plastic Rivet	

9.6.6 MECHANISM CONTROL CIRCUIT BOARD ASS'Y $\boxed{0}\boxed{6}$ PU49564A

Symbol No.	Part No.	Part Name	Description
IC 1	UPD553C-072	Integrated Circuit	
IC 2	UPD554C-036	"	
IC 3	TC4001BP	"	or UPD4001C, MSM4001, CD4001A
IC 4	TC4011BP	"	or UPD4011C, MSM4011, CD4011A
IC 5	TC4011BP	"	or "
IC 6	"	"	or "
IC 7	"	"	or "
IC 8	"	"	or "
IC 9	TC4025BP	"	or UPD4025C, MSM4025, CD4025A
IC10	–	–	
IC11	TC4028BP	"	or UPD4028C, MSM4028, CD4028A
IC12	TC4028BP	"	or "
IC13	TC4029BP	"	or UPD4029C, MSM4029, CD4029A
IC14	TC4069BP	"	or CD4069A
IC15	"	"	or "
IC16	"	"	or "
IC17	"	"	or "
IC18	"	"	or "
IC19	TC4081BP	"	or UPD4081C, MSM4081, CD4081A
IC20	TC4081BP	"	or "
IC21	"	"	or "
IC22	"	"	or "
IC23	TC4539BP	"	
IC24	"	"	
IC25	"	"	
IC26	"	"	
IC27	UPA2004C	"	
IC28	"	"	
IC29	"	"	
IC30	"	"	
IC31	"	"	
IC32	"	"	
IC33	"	"	
IC34	"	"	
IC35	"	"	
IC36	AN6551	"	
IC37	M54533P	"	
IC38	M50117AP	"	
IC39	RC4558P	"	
IC40	"	"	
IC41	"	"	
X 1	2SD389-O	Transistor	
X 2	"	"	
X 3	2SA1020-O,Y	"	
X 4	"	"	
X 5	"	"	
X 6	"	"	

Symbol No.	Part No.	Part Name	Description
X 7	2SA1020-O,Y	Transistor	
X 8	"	"	
X 9	"	"	
X10	"	"	
X11	"	"	
X12	"	"	
X13	–	–	
X14	2SA1020-O,Y	Transistor	
X15	"	"	
X16	"	"	
X17	"	"	
X18	2SC2655-O,Y	"	
X19	"	"	
X20	"	"	
X21	"	"	
X22	"	"	
X23	"	"	
X24	"	"	
X25	"	"	
X26	2SA564S	"	
X27	"	"	
X28	"	"	
X29	"	"	
X30	"	"	
X31	"	"	
X32	"	"	
X33	"	"	
X34	"	"	
X35	"	"	
X36	"	"	
X37	"	"	
X38	"	"	
X39	"	"	
X40	"	"	
X41	"	"	
X42	"	"	
X43	"	"	
X44	"	"	
X45	"	"	
X46	2SC458D	"	
X47	"	"	
X48	"	"	
X49	"	"	
X50	"	"	
D 1	WO3C	Diode	
D 2	"	"	
D 3	"	"	
D 4	"	"	
D 5	HZ15-3	Zener Diode	
D 6	1S2473HJ	Diode	
D 7	"	"	
D 8	"	"	
D 9	"	"	
D10	"	"	
D11	"	"	
D12	"	"	
D13	"	"	
D14	"	"	
D15	"	"	
D16	"	"	
D17	"	"	
D18	"	"	

Symbol No.	Part No.	Part Name	Description
D19	1S2473HJ	Diode	
D20	"	"	
D21	RD18EB2	Zener Diode	
D22	1S2473HJ	Diode	
D23	"	"	
D24	"	"	
D25	"	"	
D26	"	"	
D27	MA26TO	"	
D28	1S2473HJ	"	
D29	"	"	
D30	"	"	
D31	"	"	
D32	"	"	
D33	"	"	
D34	"	"	
D35	"	"	
D36	"	"	
D37	"	"	
D38	"	"	
D39	"	"	
D40	"	"	
D41	"	"	
D42	"	"	
D43	"	"	
D44	"	"	
D45	"	"	
D46	"	"	
D47	"	"	
D48	WO3C	"	
D49	1S2473HJ	"	
R 1	QVP4A0B-103	VR	
⚠ R 2	QRG019J-470	OMR	
⚠ R 3	" -680	"	
R 4	QRD141J-681	CR	
R 5	" -681	"	
R 6	" -681	"	
R 7	" -681	"	
R 8	" -681	"	
R 9	" -681	"	
R10	" -681	"	
R11	" -681	"	
R12	" -681	"	
R13	" -681	"	
R14	QRD187J-821	"	
R15	" -102	"	
R16	" -473	"	
R17	" -102	"	
R18	" -473	"	
R19	" -102	"	
R20	" -473	"	
R21	" -102	"	
R22	" -473	"	
R23	" -471	"	
R24	" -473	"	
R25	" -103	"	
R26	" -473	"	
R27	" -102	"	
R28	" -473	"	
R29	" -471	"	
R30	" -473	"	
R31	" -103	"	
R32	" -473	"	
R33	" -102	"	

Symbol No.	Part No.	Part Name	Description
R34	QRD187J-473	CR	
R35	" -102	"	
R36	" -473	"	
R37	" -103	"	
R38	" -473	"	
R39	" -102	"	
R40	" -473	"	
R41	" -102	"	
R42	" -473	"	
R43	" -103	"	
R44	" -473	"	
R45	" -102	"	
R46	" -473	"	
R47	" -102	"	
R48	" -473	"	
R49	" -104	"	
R50	" -102	"	
R51	" -473	"	
R52	" -103	"	
R53	" -103	"	
R54	" -104	"	
R55	" -563	"	
R56	" -823	"	
R57	" -154	"	
R58	" -154	"	
R59	" -333	"	
R60	" -103	"	
R61	" -473	"	
R62	" -333	"	
R63	" -103	"	
R64	" -104	"	
R65	" -333	"	
R66	" -472	"	
R67	" -103	"	
R68	" -103	"	
R69	" -333	"	
R70	" -333	"	
R71	" -103	"	
R72	" -333	"	
R73	" -102	"	
R74	" -333	"	
R75	" -103	"	
R76	" -333	"	
R77	" -103	"	
R78	" -102	"	
R79	" -102	"	
R80	" -103	"	
R81	" -103	"	
R82	" -101	"	
R83	" -224	"	
R84	" -103	"	
R85	" -102	"	
R86	" -104	"	
R87	" -103	"	
R88	" -474	"	
R89	" -102	"	
R90	" -333	"	
R91	" -104	"	
R92	" -104	"	
R93	" -103	"	
R94	" -104	"	
R95	" -103	"	
R96	" -103	"	

Symbol No.	Part No.	Part Name	Description
R97	QRD187J-103	CR	
R98	" -103	"	
R99	" -473	"	
R100	" -104	"	
R101	" -103	"	
R102	" -333	"	
R103	" -333	"	
R104	" -103	"	
R105	" -103	"	
R106	" -104	"	
R107	" -103	"	
R108	" -104	"	
R109	" -103	"	
R110	" -102	"	
R111	" -102	"	
R112	" -103	"	
R113	" -104	"	
R114	" -563	"	
R115	" -104	"	
R116	" -333	"	
R117	" -333	"	
R118	" -473	"	
R119	" -103	"	
R120	" -103	"	
R121	" -473	"	
R122	" -333	"	
R123	" -473	"	
R124	" -103	"	
R125	" -102	"	
R126	" -103	"	
R127	" -473	"	
R128	" -562	"	
R129	" -103	"	
R130	" -103	"	
R131	" -682	"	
R132	" -104	"	
R133	" -223	"	
R134	" -103	"	
R135	" -272	"	
R136	" -103	"	
R137	" -102	"	
R138	" -153	"	
R139	" -105	"	
R140	" -101	"	
R141	" -223	"	
R142	" -473	"	
R143	" -223	"	
R144	" -473	"	
R145	" -473	"	
R146	" -183	"	
R147	" -473	"	
R148	" -104	"	
R149	" -273	"	
R150	" -474	"	
R151	" -103	"	
R152	" -103	"	
R153	" -101	"	
R154	" -155	"	
R155	" -103	"	
R156	" -473	"	
R157	" -101	"	
R158	" -104	"	
R159	" -103	"	

Symbol No.	Part No.	Part Name	Description
R160	QRD187J-103	CR	
R161	" -473	"	
R162	" -682	"	
R163	" -473	"	
R164	" -473	"	
R165	" -103	"	
R166	" -102	"	
R167	" -473	"	
R168	" -103	"	
R169	" -473	"	
R170	" -473	"	
R171	" -103	"	
R172	" -473	"	
R173	" -103	"	
R174	" -102	"	
R175	" -473	"	
R176	" -333	"	
R177	" -333	"	
R178	" -333	"	
R179	—	—	
R180	QRD187J-103	CR	
R181	" -103	"	
R182	" -104	"	
R183	" -101	"	
R184	" -102	"	
R185	" -473	"	
R186	" -102	"	
R187	" -473	"	
R188	" -102	"	
R189	" -473	"	
R190	" -103	"	
R191	" -473	"	
R192	" -102	"	
R193	" -473	"	
R194	" -472	"	
R195	" -103	"	
R196	" -102	"	
R197	" -223	"	
R198	" -473	"	
R199	" -103	"	
R200	" -473	"	
R201	" -103	"	
R202	" -473	"	
R203	" -103	"	
R204	" -473	"	
R205	" -103	"	
R206	" -473	"	
R207	" -103	"	
R208	" -472	"	
R209	" -473	"	
R210	" -103	"	
R211	" -473	"	
R212	" -103	"	
R213	" -473	"	
R214	" -103	"	
R215	" -473	"	
R216	" -103	"	
R217	" -222	"	
R218	" -823	"	
R219	" -103	"	
R220	" -681	"	
R221	" -222	"	
R222	" -121	"	

Symbol No.	Part No.	Part Name	Description
R223	QRD187J-103	CR	
R224	〃 -562	〃	
R225	〃 -562	〃	
R226	〃 -125	〃	
R227	〃 -333	〃	
R228	〃 -223	〃	
R229	〃 -473	〃	
R230	〃 -153	〃	
R231	〃 -473	〃	
R232	〃 -682	〃	
R233	–	–	
R234	–	–	
R235	–	–	
R236	QRD187J-474	CR	
R237	〃 -104	〃	
RA-1	EXB-P88333M	Resistor Array	
RA-2	〃	〃	
RA-3	–	–	
RA-4	EXB-P84333M	Resistor Array	
RA-5	〃	〃	
RA-6	〃	〃	
RB-1	QRD181J-0R0	CR	0 Ω Resistor
RB-2	〃	〃	〃
RB-3	〃	〃	〃
RB-4	〃	〃	〃
RB-5	〃	〃	〃
RB-6	〃	〃	〃
RB-7	〃	〃	〃
RB-8	〃	〃	〃
RB-9	〃	〃	〃
RB-10	〃	〃	〃
RB-11	〃	〃	〃
RB-12	〃	〃	〃
RB-13	〃	〃	〃
RB-14	〃	〃	〃
RB-15	〃	〃	〃
RB-16	〃	〃	〃
RB-17	〃	〃	〃
RB-18	〃	〃	〃
RB-19	〃	〃	〃
RB-20	〃	〃	〃
RB-21	〃	〃	〃
RB-22	〃	〃	〃
C 1	QCS31HJ-101	C Cap	
C 2	〃 -101	〃	
C 3	〃 -101	〃	
C 4	〃 -101	〃	
C 5	〃 -101	〃	
C 6	〃 -101	〃	
C 7	〃 -121	〃	
C 8	〃 -121	〃	
C 9	QEE41C-106	T Cap	
C10	〃 -106	〃	
C11	〃 -106	〃	
C12	QET61HR-105	E Cap	
C13	–	–	
C14	QET61CR-106	E Cap	
C15	QET61ER-475	〃	
C16	〃 -475	〃	

Symbol No.	Part No.	Part Name	Description
C17	QEK61EM-475	E Cap	
C18	〃 -475	〃	
C19	QET61ER-227	〃	
C20	QET61CR-106	〃	
C21	〃 -106	〃	
C22	〃 -106	〃	
C23	〃 -226	〃	
C24	QEK61CM-226	〃	
C25	QET61CR-336	〃	
C26	QET61ER-107	〃	
C27	〃 -107	〃	
C28	〃 -476	〃	
C29	QEK60JM-476	〃	
C30	QEN41HM-105	NP Cap	
C31	QEN41CM-106	〃	
C32	〃 -106	〃	
C33	QFN31HK-182	M Cap	
C34	QET61HR-105	E Cap	
C35	QET41CR-106	〃	
C36	QFN31HK-104	M Cap	
C37	〃 -104	〃	
C38	〃 -222	〃	
C39	QET61HR-225	E Cap	
C40	QCS31HJ-331	C Cap	
C41	QET61CR-106	E Cap	
C42	〃 -337	〃	
C43	〃 -336	〃	
C44	〃 -106	〃	
C45	QET61ER-475	〃	
C46	QCS31HJ-101	C Cap	
CF 1	PU49326	Ceramic Filter	
CF 2	〃	〃	
CF 3	PU49487-1	〃	
	PU43351-2	Cap Housing	(101–102)
	〃 -2	〃	(111–112)
	〃 -2	〃	(151–152)
	〃 -2	〃	(261–262)
	〃 -2	〃	(271–272)
	〃 -3	〃	(81–83)
	〃 -3	〃	(131–133)
	〃 -3	〃	(121–123)
	〃 -4	〃	(21–24)
	〃 -4	〃	(31–34)
	〃 -4	〃	(201–204)
	〃 -4	〃	(211–214)
	〃 -4	〃	(191–194)
	〃 -6	〃	(61–66)
	〃 -5	〃	(91–95)
	〃 -5	〃	(141–145)
	〃 -5	〃	(161–165)
	〃 -7	〃	(71–77)
	〃 -8	〃	(231–238)
	〃 -9	〃	(221–229)
	〃 -9	〃	(11–19)
	〃 -12	〃	(241–252)
	〃 -14	〃	(41–54)
	〃 -16	〃	(171–186)
	PU32566	Circuit Board Frame	
	E48729-001	Plastic Rivet	

Symbol No.	Part No.	Part Name	Description
	PU41624-6	Isolation Washer	
	PU32562	Heat Sink	
	GPST3006ZS	Tap. Screw	
	PU45375-3	Tr. Spacer	
	LPSP3006ZS	Screw	

9.6.7 JUNCTION CIRCUIT BOARD ASS'Y $\boxed{0}\boxed{7}$

PU49458A(EG)
.... PU49458B(EK)

Symbol No.	Part No.	Part Name	Description
IC 1	MSM4069	Integrated Circuit	
IC 2	TC4066BP	"	
IC 3	UPD4066C	"	
X 1	PN202S	Photo Transistor	
X 2	2SC2063Q	Transistor	
X 3	"	"	
X 4	2SC2647C	"	
X 5	2SD638R	"	
X 6	2SC2063Q	"	
X 7	"	"	
X 8	"	"	
X 9	"	"	
X10	"	"	
X11	"	"	
X12	2SD638R	"	
X13	–	–	
X14	–	–	
X15	2SA874QR	Transistor	
D 1	1S2473HJ	Diode	
D 2	"	"	
D 3	"	"	
D 4	–	–	
D 5	1S2473HJ	Diode	
D 6	"	"	
D 7	"	"	
D 8	OA91	"	
D 9	1S2473HJ	"	
D10	"	"	
D11	"	"	
D12	"	"	
D13	"	"	
D14	–	–	
D15	–	–	
D16	–	–	
D17	1S2076A	Diode	
D18	1S2473HJ	"	
R 1	QRD187J-562	CR	
R 2	–	–	
R 3	QRD187J-222	CR	
R 4	" -331	"	
R 5	" -183	"	
R 6	" -474	"	
R 7	–	–	
R 8	QRD187J-103	CR	
R 9	" -123	"	
R10	" -332	"	
R11	" -103	"	
R12	QRD121J-331	"	
R13	QRD187J-103	"	
R14	" -103	"	
R15	" -221	"	
R16	" -103	"	
R17	" -820	"	
R18	" -561	"	
R19	" -820	"	EG only
	" -101	"	EK only

Symbol No.	Part No.	Part Name	Description
R20	QRD187J-561	CR	
R21	" -560	"	EG only
	" -470	"	EK only
R22	" -471	"	
R23	" -122	"	EG only
	" -102	"	EK only
R24	" -681	"	
R25	" -102	"	
R26	" -681	"	
R27	" -183	"	
R28	" -682	"	
R29	" -472	"	
R30	" -222	"	
R31	" -222	"	
R32	" -124	"	
R33	" -682	"	
R34	" -333	"	
R35	QVZ3505-682	VR	
R36	QRD187J-221	CR	
R37	" -103	"	
R38	" -153	"	
R39	" -223	"	
R40	" -274	"	
R41	" -103	"	
R42	" -103	"	
R43	" -103	"	
R44	" -104	"	
R45	" -224	"	
R46	–	–	
R47	QRD187J-750	CR	
R48	" -562	"	
R49	" -224	"	
R50	" -224	"	
R51	" -124	"	
R52	" -224	"	
R53	" -124	"	
R54	" -103	"	
R55	" -103	"	
R56	" -391	"	
R57	" -182	"	
R58	–	–	
R59	–	–	
R60	–	–	
R61	QRD187J-750	CR	
R62	" -223	"	
R63	" -152	"	
R64	" -182	"	
R65	" -332	"	
R66	–	–	
R67	QRD187J-224	CR	
R68	" -124	"	
R69	" -124	"	
R70	–	–	
R71	QRD187J-473	CR	
C 1	QET61ER-475	E Cap	
C 2	QCF31HP-223	C Cap	
C 3	QET61CR-336	E Cap	
C 4	" -107	"	
C 5	QET61AR-477	"	
C 6	QCF31HP-223	C Cap	

Symbol No.	Part No.	Part Name	Description
C 7	QET60JR-476	E Cap	
C 8	QCS31HJ-560	C Cap	
C 9	QET60JR-227	E Cap	
C10	" -107	"	
C11	QET61CR-476	"	
C12	QET61HR-105	"	
C13	" -105	"	
C14	QET61CR-106	"	
C15	QFN31HK-392	MY Cap	
C16	QFM71HJ-102	"	
C17	QFN31HK-152	"	
C18	QET61CR-476	E Cap	
C19	" -106	"	
C20	QET60JR-476	"	
C21	–	–	
C22	QET61AR-476	E Cap	
C23	" -476	"	
C24	QEN61AM-476	NP Cap	
C25	QET61CR-106	E Cap	
C26	–	–	
C27	QET61CR-106	E Cap	
C28	" -106	"	
C29	" -106	"	
C30	" -106	"	
C31	" -106	"	
C32	QET60JR-107	"	
C33	" -476	"	
C34	QCS31HJ-220	C Cap	
L 1	A04725-68	Peaking Coil	
L 2	PU46021-101	Choke Coil	or PU49993-101
EQ1	PU31933-3	Equalizer	EG only
	PU43351-6	Cap Housing	(11–16)
	" -9	"	(21–29)
	" -8	"	(31–38)
	" -9	"	(41–49)
	" -2	"	(51–52)
	" -5	"	(61–65)
	" -4	"	(71–74)
	" -6	"	(81–86)
	" -4	"	(91–94)
	" -6	"	(101–106)
	" -5	"	(111–115)
	" -5	"	(121–125)
	PU49467	Shade	for X1
	PU45908	Test Pin	TP1, 2

9.6.8 DISPLAY CONTROL CIRCUIT BOARD ASS'Y $\boxed{0}\boxed{8}$ PU49395A

Symbol No.	Part No.	Part Name	Description
IC 1	UPD552C-045	Integrated Circuit	
IC 2	" -045	"	
IC 3	TD62705P	"	
IC 4	"	"	
IC 5	BA222	"	
IC 6	MSM4011	"	
X 1	2SC2647C	Transistor	
D 1	1S2473	Diode	
D 2	"	"	
D 3	"	"	
RA 1	EXB-P89104M	Resistor Array	
RA 2	"	"	
RA 3	"	"	
RA 4	"	"	
RA 5	EXB-P84333M	"	
RA 6	EXB-P812333M	"	
RA 7	–	–	
RA 8	EXB-P84333M	Resistor Array	
R 1	QRD187J-103A	CR	
R 2	" -103A	"	
R 3	" -103A	"	
R 4	" -103A	"	
R 5	" -103A	"	
R 6	" -103A	"	
R 7	" -103A	"	
R 8	" -103A	"	
R 9	" -103A	"	
R10	–	–	
R11	QRD187J-103A	CR	
R12	" -333A	"	
R13	" -103A	"	
R14	–	–	
R15	QRD187J-103A	CR	
R16	" -103A	"	
R17	" -103A	"	
R18	" -103A	"	
R19	" -334A	"	
R20	" -103A	"	
R21	" -333A	"	
R22	" -104A	"	
R23	" -104A	"	
R24	" -473A	"	
R25	" -472A	"	
R26	" -472A	"	
C 1	QCF31HP-102	C Cap	
C 2	" -102	"	
C 3	" -102	"	
C 4	" -102	"	
C 5	" -103	"	
C 6	QET61VR-336	E Cap	
C 7	QCF31HP-103	C Cap	
C 8	QET61ER-107	E Cap	
C 9	QCF31HP-103	C Cap	
C10	–	–	
C11	QCF31HP-103	C Cap	
C12	QET61CR-476	E Cap	
C13	" -107	"	
C14	QCS31HJ-221	C Cap	
C15	" -121	"	
C16	QFN31HK-103	MY Cap	
C17	" -124	"	
C18	QCS31HJ-121	C Cap	
C19	" -221	"	
C20	–	–	
C21	QCF31HP-102	C Cap	
C22	QFH52AM-474	MY Cap	
C23	" -474	"	
L 1	PU30284-45R	Choke Coil	
L 2	A04725-10	Peaking Coil	
CF1	PU49326	Ceramic Filter	
CF2	"	"	
⚠	PU49128	DC/DC Converter Ass'y	
	PU47903	IC Socket	for IC1, 2
P 1	PU43351-106	Cap Housing	
P 2	" -120	"	
P 3	" -20	"	
P 4	" -20	"	

9.6.9 T/T CONTROL CIRCUIT BOARD ASS'Y $\boxed{0}\boxed{9}$

PU49387A-1(EG)
.... PU49387B-1(EK)

Symbol No.	Part No.	Part Name	Description
IC 1	UPD546C-166	Integrated Circuit	
IC 2	UPD650C-049	"	
IC 3	SM5502A	"	
IC 4	MC14584BP	"	
IC 5	MN1208	"	
IC 6	–	–	
IC 7	MN1208	Integrated Circuit	EG only
IC 8	"	"	
IC 9	MN1204A	"	
IC10	TC4093BP	"	
IC11	MB4204M	"	
IC12	UPC574J-KL	"	
IC13	TL061CP	"	
IC14	MB4204M	"	
IC15	AN5750	"	
TA 1	TA57	Transistor Array	
TA 2	"	"	
TA 3	UPA2003C	"	
TA 4	"	"	
TA 5	"	"	
X 1	2SB745S	Transistor	
X 2	"	"	
X 3	2SD638R	"	
X 4	"	"	
X 5	2SC2647C	"	
X 6	2SA673C	"	
X 7	2SC1545B	"	
X 8	2SB745S	"	
X 9	2SD638R	"	
X10	2SC2546E	"	
X11	2SB745S	"	EG only
X12	"	"	EG only
X13	2SC2647C	"	
X14	2SB745S	"	
X15	2SD889R	"	
X16	2SC2647C	"	
X17	2SB745S	"	
D 1	1SS133HV	Diode	
D 2	"	"	
D 3	"	"	
D 4	"	"	
D 5	"	"	
D 6	"	"	
D 7	"	"	
D 8	"	"	
D 9	"	"	
D10	"	"	
D11	1S2473HJ	"	
D12	"	"	
D13	"	"	
D14	"	"	
D15	RD8.2EB	Zener Diode	
D16	1SS133HV	Diode	
D17	1S2473HJ	"	
D18	"	"	
D19	OA90	"	
D20	1S2473HJ	"	

Symbol No.	Part No.	Part Name	Description
D21	WO3C	Diode	
D22	"	"	
D23	1S2473	"	
RA1	EXB-P812333M	Resistor Array	
RA2	EXB-P84333M	"	
RA3	EXB-P88333M	"	
RA4	EXB-P88333M	"	
RA5	EXB-P84333M	"	
RA6	EXB-P84333M	"	
RA7	EXB-P84333M	"	
RA8	EXB-P84333M	"	
RA9	EXB-P88103M	"	
R 1	QRD187J-333A	CR	
R 2	" -333A	"	
R 3	" -333A	"	
R 4	" -333A	"	
R 5	" -333A	"	
R 6	" -333A	"	
R 7	" -333A	"	
R 8	" -333A	"	
R 9	" -333A	"	
R10	–	–	
R11	QRD187J-333A	CR	
R12	" -333A	"	
R13	" -104A	"	
R14	" -333A	"	
R15	" -103A	"	
R16	" -103A	"	
R17	" -333A	"	
R18	" -333A	"	
R19	" -333A	"	
R20	–	–	
R21	QRD187J-333A	CR	
R22	" -333A	"	
R23	" -333A	"	
R24	" -105A	"	
R25	" -822A	"	
R26	" -154A	"	
R27	" -102A	"	
R28	" -333A	"	
R29	" -102A	"	
R30	" -333A	"	
R31	" -154A	"	
R32	" -333A	"	
R33	" -333A	"	
R34	" -333A	"	
R35	" -333A	"	
R36	" -333A	"	
R37	" -333A	"	
R38	" -333A	"	
R39	" -153A	"	
R40	–	–	
R41	QRD187J-103A	CR	
R42	" -103A	"	
R43	" -333A	"	
R44	" -472A	"	
R45	" -102A	"	
R46	" -682A	"	
R47	" -103A	"	
R48	" -102A	"	

Symbol No.	Part No.	Part Name	Description
R49	QRD187J-473A	CR	
R50	–	–	
R51	QRD187J-472A	CR	
R52	″ -103A	″	
R53	″ -103A	″	
R54	″ -103A	″	
R55	″ -223A	″	
R56	″ -222A	″	
R57	″ -103A	″	
R58	″ -333A	″	
R59	″ -223A	″	
R60	–	–	
R61	QRD187J-123A	CR	
R62	″ -333A	″	
R63	″ -333A	″	
R64	″ -333A	″	
R65	″ -563A	″	
R66	″ -103A	″	
R67	″ -333A	″	
R68	″ -222A	″	
R69	″ -333A	″	
R70	–	–	
R71	QRD187J-103A	CR	
R72	″ -562A	″	
R73	″ -103A	″	
R74	″ -222A	″	
R75	″ -824A	″	
R76	″ -392A	″	
R77	″ -392A	″	
R78	″ -392A	″	
R79	″ -392A	″	
R80	–	–	
R81	QRD187J-333A	CR	
R82	″ -154A	″	
R83	″ -124A	″	
R84	″ -124A	″	
R85	″ -473A	″	
R86	″ -224A	″	
⚠R87	QRG029J-102G	OMR	
R88	–	–	
R89	QRD187J-333A	CR	
R90	–	–	
R91	QRD187J-333A	CR	
R92	″ -224A	″	
R93	″ -333A	″	EG only
R94	″ -103A	″	EG only
R95	″ -562A	″	EG only
R96	″ -103A	″	EG only
R97	″ -333A	″	EG only
R98	″ -103A	″	EG only
R99	″ -333A	″	EG only
R100	–	–	
R101	QRD187J-105A	CR	
R102	″ -103A	″	
R103	″ -105A	″	
R104	″ -563A	″	
R105	″ -332A	″	
R106	″ -332A	″	
R107	″ -393A	″	
R108	″ -183A	″	
R109	″ -562A	″	
R110	–	–	
R111	QRD187J-332A	CR	

Symbol No.	Part No.	Part Name	Description
R112	QRD187J-222A	CR	
R113	″ -154A	″	
R114	″ -221	″	
R115	″ -103A	″	
R116	″ -122A	″	
R117	″ -561A	″	
R118	″ -223A	″	
R119	″ -273A	″	
R120	–	–	
R121	QRD187J-272A	CR	
R122	QVZ3506-102	VR	
R123	QRD187J-471	CR	
R124	″ -472A	″	
R125	″ -153A	″	
R126	″ -472A	″	
R127	″ -223A	″	
R128	″ -333A	″	
R129	″ -103A	″	
R130	–	–	
R131	QRD187J-103A	CR	
R132	–	–	
R133	–	–	
R134	QRD187J-223A	CR	
R135	″ -561A	″	
R136	″ -223A	″	
R137	″ -221	″	
R138	″ -103A	″	
R139	″ -333A	″	
R140	–	–	
R141	QRD187J-222A	CR	
R142	″ -332A	″	
R143	″ -332A	″	
R144	″ -332A	″	
R145	″ -332A	″	
R146	″ -332A	″	
C 1	QCS31HJ-101	C Cap	
C 2	″ -101	″	
C 3	″ -101	″	
C 4	″ -101	″	
C 5	QET60JR-336	E Cap	
C 6	QET61HR-225	″	
C 7	QCT31CH-8R0	C Cap	
C 8	″ -5R0	″	
C 9	QAT3001-015	Trimmer Cap	
C10	–	–	
C11	QET61ER-475	E Cap	
C12	QCS31HJ-471	C Cap	
C13	″ -151	″	
C14	″ -471	″	
C15	QFN31HK-103	MY Cap	
C16	QET61ER-475	E Cap	
C17	″ -475	″	
C18	QEE41CM-225	T Cap	
C19	″ -475	″	
C20	–	–	
C21	QEE41CM-226	T Cap	
C22	QET61CR-476	E Cap	
C23	QET60JR-476	″	
C24	QFN31HK-273	MY Cap	
C25	–	–	
C26	QET61HR-474	E Cap	

Symbol No.	Part No.	Part Name	Description
C27	QET61HR-225	E Cap	
C28	QFN31HK-124	MY Cap	
C29	" -124	"	
C30	–	–	
C31	QFN31HK-124	MY Cap	
C32	" -124	"	
C33	" -104	"	
C34	QET61HR-474	E Cap	
C35	QET61VR-107	"	
C36	QET60JR-107	"	
C37	QFN31HK-103	MY Cap	
C38	–	–	
C39	QET61HR-225	E Cap	
C40	–	–	
C41	QFN31HK-103	MY Cap	
C42	" -103	"	
C43	QCS31HJ-180	C Cap	
C44	" -101	"	
C45	QFN31HK-104	MY Cap	
C46	QCS31HJ-121	C Cap	
C47	QET61ER-475	E Cap	
C48	QFN31HK-272	MY Cap	
C49	QCS31HJ-471	C Cap	
C50	–	–	
C51	QFN31HK-103	MY Cap	
C52	" -472	"	
C53	QFS42BJ-682	PS Cap	
C54	QFP42AF-272M	PP Cap	
C55	QET61CR-476	E Cap	
C56	QFN31HK-272	MY Cap	
C57	QET61HR-335	E Cap	
C58	QFN31HK-122	MY Cap	
C59	QET61CR-476	E Cap	
C60	–	–	
C61	QET61CR-106	E Cap	
L 1	PU46003-151	Peaking Coil	
L 2	A04725-122	"	
CF 1	PU49447	Ceramic Filter	
CF 2	"	"	
X'TAL	PU47695	Crystal	
	PU47903	IC Socket	for IC1, IC2
P 1	PU43351-16	Cap Housing	
P 2	" -8	"	
P 3	" -6	"	
P 4	" -20	"	
P 5	" -7	"	
P 6	" -12	"	
P 7	" -10	"	
	PU45908-3	Test Pin	TP1–TP3

9.6.10 POWER SUPPLY CIRCUIT BOARD ASS'Y
1 0 .... PU49161A

Symbol No.	Part No.	Part Name	Description
IC 1	UPC78L05	Integrated Circuit	
X 7	2SD637S	Transistor	
X 8	"	"	
X 9	2SD639S	"	
X10	–	–	
X11	2SD637S	Transistor	
X12	"	"	
X13	"	"	
X14	2SD1128-02	P. Transistor	
X15	2SD637S	Transistor	
X16	2SD638R	"	
X17	2SD1128-02	P. Transistor	
D 1	HZ6A2L	Zener Diode	
D 2	HZ7A1L	"	
D 3	1S2076A	Diode	
D 4	WO3C	"	
D 5	HZ12C3L	Zener Diode	
D 6	1S2076A	Diode	
D 7	VO3C	"	
D 8	"	"	
D 9	"	"	
D10	"	"	
D11	–	–	
D12	–	–	
D13	HZ12C1L	Zener Diode	
D14	WO3C	Diode	
D15	HZ12B3L		
D16	WO3C		
D17	HZ6A2L		
D18	1S2076A	Diode	
D19	"	"	
D20	"	"	
D21	"	"	
D22	"	"	
D23	"	"	
D24	"	"	
D25	"	"	
D26	"	"	
D27	VO3E(F)	"	
D28	WO3C	"	
D29	HZ24-1L	Zener Diode	
D30	–	–	
D31	HZ20-2L	Zener Diode	
D32	HZ22-2L	"	
D33	1S2076A	Diode	
D34	HV-70	"	
DS2	S4VB10	Bridge Diode	
DS3	S10VB10F	"	
R 1	–	–	
⚠ R 2	QRZ0054-2R0-BS	Fusible Resistor	
R 3	QRD187J-222	CR	
R 4	" -222	"	
R 5	–	–	
R 6	–	–	
R 7	QRD187J-821	CR	

Symbol No.	Part No.	Part Name	Description
R 8	QRD187J-102	CR	
R 9	QVP4A0B-102	VR	
R10	–	–	
R11	QRD187J-222	CR	
R12	" -222	"	
R13	" -222	"	
⚠ R14	QRX019J-R47S	OMR	
⚠ R15	" -R47S	"	
R16	QRD187J-821	CR	
R17	" -470	"	
R18	" -102	"	
R19	QVP4A0B-102	VR	
R20	QRD187J-222	CR	
R21	" -222	"	
R22	" -332	"	
R23	QVP4A0B-102	VR	
R24	QRD141J-472	CR	
R25	QRD187J-470	"	
R26	" -272	"	
R27	" -152	"	
R28	" -222	"	
R29	" -223	"	
R30	" -153	"	
R31	" -223	"	
R32	" -470	"	
R33	" -122	"	
R34	" -683	"	
⚠ R35	QRZ0047-121-BS	Fusible Resistor	
⚠ R36	QRG019J-152	OMR	
⚠ R37	" -182	"	
⚠ R38	QRZ0054-2R0-BS	Fusible Resistor	
⚠ R39	" -4R7-BS	"	
⚠ C 1	QFH52AM-224	MM Cap	
C 2	–	–	
C 3	–	–	
C 4	–	–	
C 5	–	–	
⚠ C 6	QFH52AM-224	MM Cap	
⚠ C 7	QCF32HP-103	C Cap	
⚠ C 8	" -103	"	
⚠ C 9	QCF12HP-103	"	
C10	QFN31HK-224	MY Cap	
⚠ C11	QCF12HP-103	C Cap	
⚠ C12	QCF32HP-103	"	
C13	QFN31HK-223	MY Cap	
C14	QEL71ER-338	E Cap	
C15	QET61ER-107	"	
C16	QET61CR-107	"	
C17	QEL71VR-478	"	
C18	QET61VR-107	"	
C19	QET61CR-227	"	
C20	QFN31HK-224	MY Cap	
⚠ C21	QFH52AM-224	MM Cap	
⚠ C22	QCF12HP-103	C Cap	
⚠ C23	QCF32HP-103	"	
⚠ C24	" -103	"	
⚠ C25	" -103	"	
C26	QEL71VR-478	E Cap	
C27	QET61ER-107	"	
C28	QET61ER-107	E Cap	
C29	QFN31HK-123	M Cap	
C30	" -123	"	
⚠ C31	QFH52AM-224	MM Cap	
⚠ C32	QCF32HP-103	C Cap	
⚠ C33	" -103	"	
⚠ C34	" -103	"	
⚠ C35	" -103	"	
C36	QEL71VR-478	E Cap	
C37	QET61CR-107	"	
C38	QET61ER-226	"	
C39	QET61HR-106	"	
C40	QFN31HK-103	M Cap	
⚠ C41	QCF32HP-103	C Cap	
C42	QET61HR-337	E Cap	
C43	" -475	"	
C44	" -106	"	
C45	" -106	"	
⚠ C46	QCF32HP-103	C Cap	
C47	QET62AR-107	E Cap	
C48	QET61HR-105	"	
C49	QCF31HP-103	C Cap	
C50	–	–	
C51	QCF31HP-103	C Cap	
C52	QET61HR-106	E Cap	
C53	" -106	"	
⚠ C54	QCF32HP-103	C Cap	
C55	QET61HR-227	E Cap	
C56	QET61VR-476	"	
RY1	PU49449	Relay	
	A75802-3	Mini Connector Base	(Conn. 3)
	" -4	"	(Conn. 1, 2)
	" -5	"	(Conn. 4)
	PU43351-2R	Cap Housing	(Conn. 12)
	" -3	"	(Conn. 5, 6, 7, 8, 9, 14)
	" -4R	"	(Conn. 17)
	" -6	"	(Conn. 15)
	" -9	"	(Conn. 16)
	" -10	"	(Conn. 11)
	" -3R	"	(Conn. 10)
	" -3Y	"	(Conn. 13)
	A44594-001	Fuse Clip	F2 – F6
	PU45908-2	Test Pin	TP1–TP11
	PU49476	Board Spacer	
	PU49764	Heat Sink	(X14, X17)
	LPSP3008ZS	Screw	
	PU49801	Heat Sink	(DS3)
	LPSP3010ZS	Screw	

9.6.11 IF AMP CIRCUIT BOARD ASS'Y 1 1

.... PU49380A(EG)
PU49812A(EK)

Symbol No.	Part No.	Part Name	Description
IC 1	AN5111	Integrated Circuit	
IC 2	AN5732	"	
IC 3	UPC358C	"	EG only
	UPC574J(K,L)	"	EK only
IC 4	UPD4066C	"	EG only
IC 5	UPC4557C	"	EG only
IC 6	UPC574J(K,L)	"	EG only
X 1	2SC2647C	Transistor	
X 2	"	"	
X 3	"	"	
X 4	2SC1213A(D)	"	
X 5	2SD637R	"	
X 6	"	"	
X 7	"	"	
X 8	"	"	
X 9	"	"	
X10	"	"	EG only
D 1	RD9.1EB3	Zener Diode	
D 2	1SS133HV	Diode	EG only
D 3	"	"	
D 4	1SV68	V. Cap. Diode	
D 5	1SS133HV	Diode	
D 6	–	–	
D 7	1SS133HV	Diode	EG only
D 8	"	"	EG only
D 9	"	"	EG only
D10	"	"	EG only
D11	"	"	EG only
D12	"	"	EG only
R 1	QRD187J-821	CR	EG only
	" -222	"	EK only
R 2	" -222A	"	
R 3	" -183A	"	
R 4	" -104A	"	
R 5	" -182A	"	
R 6	QVP4A0B-222	VR	
R 7	QRD187J-182A	CR	
R 8	" -101A	"	
R 9	" -471A	"	EG only
	" -221A	"	EK only
R10	QRD181J-101	"	EG only
R11	QRD187J-332A	"	
R12	" -224A	"	
R13	" -274A	"	
R14	–	–	
R15	QRD187J-182A	CR	
R16	" -822A	"	
R17	" -682A	"	
R18	" -104A	"	
R19	" -332A	"	
R20	–	–	
R21	QRD187J-391A	CR	
R22	" -221A	"	
R23	" -472A	"	
R24	" -102A	"	
R25	" -273A	"	
R26	" -561A	"	

Symbol No.	Part No.	Part Name	Description
R27	QRD187J-274A	CR	
R28	" -102A	"	
R29	QVP4A0B-682	VR	
R30	QRD187J-332A	CR	
R31	" -473A	"	
R32	" -123A	"	
R33	QVP4A0B-222	VR	
R34	QRD187J-153A	CR	
R35	QVP4A0B-682	VR	
R36	QRD187J-561A	CR	
R37	" -272A	"	
R38	" -273A	"	
R39	" -152A	"	
R40	" -680A	"	
R41	" -153A	"	
R42	" -153A	"	
R43	" -561A	"	
R44	" -272A	"	
R45	" -222A	"	
R46	QRD127J-271	"	
R47	QRD187J-750	"	
⚠ R48	QRZ0054-220-BS	Fusible Resistor	
⚠ R49	" -330-BS	"	
R50	–	–	
R51	QRD187J-472A	CR	
R52	QVP4A0B-103	VR	
R53	QRD187J-333A	CR	
R54	" -563A	"	
R55	" -563A	"	
R56	" -562A	"	
R57	" -334A	"	EG only
	" -563A	"	EK only
R58	" -334A	"	EG only
	" -103A	"	EK only
R59	" -223A	"	EG only
	" -183A	"	EK only
R60	" -105A	"	EG only
R61	" -223A	"	EG only
	" -332A	"	EK only
R62	" -224A	"	EG only
	" -183A	"	EK only
R63	" -104A	"	EG only
	" -184A	"	EK only
R64	" -394A	"	EG only
	" -224A	"	EK only
R65	" -224A	"	EG only
	" -274A	"	EK only
R66	" -683A	"	EG only
⚠	QRF036J-102	Unflammable R	EK only
R67	QRD187J-223A	CR	EG only
	QRD147J-103	"	EK only
R68	QRD187J-104A	"	EG only
R69	" -153A	"	"
R70	" -184A	"	"
R71	" -563A	"	"
R72	" -104A	"	"
R73	" -183A	"	"
R74	" -104A	"	"
R75	" -224A	"	"
R76	" -274A	"	"
R77	" -104A	"	"
R78	" -564A	"	"
R79	–	–	

Symbol No.	Part No.	Part Name	Description
R80	QRD187J-274A	CR	EG only
R81	" -472A	"	"
R82	" -824A	"	"
R83	" -564A	"	"
R84	" -822A	"	"
R85	" -182A	"	"
R86	" -151A	"	"
R87	—	—	
R88	QRD187J-104A	CR	EG only
R89	" -104A	"	"
R90	" -102A	"	"
R91	" -104A	"	"
R92	QRD147J-103	"	"
⚠R93	QRF036J-561	Unflammable R	"
R94	QRD187J-222A	CR	"
R95	" -184A	"	"
R96	" -104A	"	"
R97	" -124A	"	"
R98	" -563A	"	"
R99	" -103A	"	"
R100	—	—	
R101	QRD187J-183A	CR	EG only
R102	" -332A	"	"
R103	" -183A	"	"
R104	" -104A	"	"
R105	—	—	
R106	QRD187J-103A	CR	EG only
R107	" -332A	"	"
R108	" -393A	"	"
R109	" -393A	"	"
R110	—	—	
R111	QRD187J-393A	CR	EG only
R112	" -393A	"	"
R113	" -393A	"	"
R114	" -333A	"	"
C 1	QCF31HP-222	C Cap	
C 2	" -103	"	
C 3	" -103	"	
C 4	" -103	"	
C 5	QET61HR-474	E Cap	
C 6	QCT25CH-2R0	C Cap	EG only
	" -3R0	"	EK only
C 7	" -2R0	"	
C 8	QCT25HH-680	"	EG only
	" -560	"	EK only
C 9	QCS31HJ-470	"	
C10	QCT25CH-6R0	"	EG only
	" -560	"	EK only
C11	QCF31HP-103	"	
C12	QET61CR-106	E Cap	
C13	QCF31HP-103	C Cap	
C14	QET61HR-105	E Cap	
C15	" -105	"	
C16	QCT25RH-560	C Cap	
C17	QCT25CH-6R0	"	
C18	" -120	"	
C19	QCT25RH-151	"	
C20	QCT25CH-150	"	
C21	QET61AR-476	E Cap	
C22	QET61CR-106	"	
C23	QCF31HP-103	C Cap	

Symbol No.	Part No.	Part Name	Description
C24	QCS31HJ-470	C Cap	
C25	QFM31HK-473	MY Cap	
C26	QCF31HP-102	C Cap	
C27	QEE41VM-334	T Cap	
C28	QEE41CM-685	"	
C29	QET61ER-335	E Cap	
C30	—	—	
C31	QCS31HJ-220	C Cap	
C32	QET61AR-476	E Cap	
C33	QCS31HJ-221	C Cap	
C34	" -220	"	
C35	QET61CR-106	E Cap	
C36	QET61AR-476	"	
C37	QFM31HK-102	MY Cap	
C38	QET61AR-477	E Cap	
C39	QET61CR-227	"	
C40	—	—	
C41	QCF31HP-103	C Cap	
C42	—	—	
C43	QCF31HP-222	C Cap	
C44	QFM31HK-473	MY Cap	
C45	QET61CR-106	E Cap	
C46	QCF31HP-103	C Cap	
C47	QCT25CH-120	"	
C48	QFM31HK-183	MY Cap	
C49	QET61CR-106	E Cap	
C50	—	—	
C51	—	—	
C52	—	—	
C53	QCF31HP-103	C Cap	
C54	QET61CR-106	E Cap	
C55	QET61HR-474	"	EG only
	" -476	"	EK only
C56	" -475	"	EG only
	QCF31HP-103	C Cap	EK only
C57	" -103	"	EG only
	QET61HR-105	E Cap	EK only
C58	" -105	E Cap	
C59	QET61ER-475	"	EG only
C60	—	—	
C61	QFM31HK-123	MY Cap	EG only
C62	" -123	"	"
C63	" -123	"	"
C64	" -123	"	"
C65	QCF31HP-103	C Cap	"
C66	QET61HR-476	E Cap	"
C67	QFM31HK-682	MY Cap	"
C68	QCS31HJ-560	C Cap	"
C69	QET61HR-105	E Cap	"
L 1	A04725-5.6	Peaking Coil	
L 2	" -100	"	
L 3	" -1.8	"	
L 4	" -39	"	
L 5	" -39	"	
T 1	PU32176-2	Coil	EG only
	" -3	"	EK only
T 2	PU32167-4	"	
T 3	PU32177-3	"	
T 4	PU32178-2	"	EG only

Symbol No.	Part No.	Part Name	Description
T 4	PU32178-3	Coil	EK only
T 5	PU32179-2	"	EG only
	" -3	"	EK only
T 6	PU32180-2	"	EG only
	" -3	"	EK only
HLB 1	PU49373	HLB Filter	EG only
	PU49813	"	EK only
CF 1	PU49295	Ceramic Filter	EG only
	PU49814	"	EK only
P 1	PU43351-4	Cap Housing	
P 2	" -12	"	
P 3	" -7	"	
	PU20991	Shield Case (1)	
	PU20992	" (2)	
	PU20993	" (3)	
	PU45908-3	Test Pin	TP10–14, 16, 21–23, E

9.6.12 TERMINAL CIRCUIT BOARD (VIDEO HEAD) $\boxed{1}\boxed{7}$

Symbol No.	Part No.	Part Name	Description
	PU44674	Terminal Circuit Board	

9.6.13 CONNECTOR CIRCUIT BOARD $\boxed{1}\boxed{8}$ PU49482B

Symbol No.	Part No.	Part Name	Description
	PU49461	Connector Circuit Board	
	PU49217-6	Receptacle Housing	
	PU43351-2	Cap Housing	

9.6.14 DISPLAY HOLDER CIRCUIT BOARD ASS'Y $\boxed{2}\boxed{2}$. PU49613A

Symbol No.	Part No.	Part Name	Description
	PU32576	F.D.P. Holder Circuit Board	
	PU49446-2	F. Display Panel	
	PU43351-20	Connector	
	PU32577A-20-12	Wire Ass'y	

9.6.15 KEY SEARCH(B) CIRCUIT BOARD ASS'Y $\boxed{2}\boxed{4}$. PU49493A

Symbol No.	Part No.	Part Name	Description
IC 1	M50115AP	Integrated Circuit	
X 1	2SC2063Q	Transistor	
D 1	1S2473HJ	Diode	
D 2	SLB-26UR3F	L.E.D.	
D 3	"	"	
D 4	"	"	
D 5	"	"	
D 6	"	"	
D 7	"	"	
D 8	"	"	
D 9	"	"	
D10	"	"	
D11	"	"	
D12	"	"	
R 1	QRD142K-221	CR	
R 2	QRD187J-224A	"	
R 3	" -224A	"	
R 8	QRD142K-821	"	
C 1	QCS31HJ-101	C Cap	
C 2	" -101	"	
CF1	PU49487-2	Ceramic Filter	
PI 1	PS4005	Photo Interrupter	
	PU41624-6	Isolation Washer	
	PU49558	Spacer	

9.6.16 POWER SUPPLY DIODE CIRCUIT BOARD $\boxed{2}\boxed{9}$

Symbol No.	Part No.	Part Name	Description
DS 1	M4B31-13	Diode Stack	
C 1	–	–	
C 2	QCF32HP-103	FC Cap	
C 3	" -103	"	
C 4	" -103	"	
C 5	" -103	"	
	PU49442	Circuit Board	
	LPSP3012ZS	Ass'y Screw	

9.6.17 SWITCH BOARD $\boxed{3}\boxed{1}$

Symbol No.	Part No.	Part Name	Description
	QRD187J-333	CR	
	PU49439	Switch Board	

9.6.18 SWITCH CIRCUIT BOARD ASS'Y 3 3 .... PU49456A

Symbol No.	Part No.	Part Name	Description
X 1	2SC2063Q	Transistor	
R 1	QRD187J-223	CR	
R 2	" -223	"	
R 3	QRD142J-821	"	
S 1	QSP0028-302	Push Switch	
S 2	" -302	"	
S 3	" -302	"	
S 4	" -302	"	
S 5	" -302	"	
S 6	" -302	"	
	PU32548	Circuit Board	

PUSH SWITCH CIRCUIT BOARD ASS'Y 3 4

Symbol No.	Part No.	Part Name	Description
S 2	QSP2210-060	Push Switch	
S 3	" -060	"	

9.6.19 KEY SEARCH(A) CIRCUIT BOARD ASS'Y 3 5 .... PU49457A (EG) .... PU49457B (EK)

Symbol No.	Part No.	Part Name	Description
D 1	1S2473	Diode	
D 2	"	"	
D 3	"	"	
D 4	"	"	
D 5	"	"	
D 6	"	"	
D 7	"	"	
D 8	"	"	
D 9	"	"	
D10	"	"	
D11	"	"	
D12	"	"	
D13	"	"	
D14	"	"	EG only
D15	"	"	
D16	"	"	EG only
D17	"	"	
D18	"	"	
D19	"	"	
D20	"	"	
D21	"	"	
D22	"	"	
D23	"	"	EK only
D24	"	"	EK only
S 1	QSS1201-013	Slide Switch	
P 1	PU43351-8	Cap Housing	
P 2	" -2	"	
P 3	" -4	"	
P 4	" -6	"	
	PU32547	Circuit Board	

9.6.20 IFR RECEIVER CIRCUIT BOARD ASS'Y 3 6 .... PU49500A

Symbol No.	Part No.	Part Name	Description
IC 1	TDA4050	Integrated Circuit	
X 1	2SK105H	F.E.T.	
D 1	PH302	Photo Diode	Incl: PU49266 Stopper
D 2	1SS133HV	Diode	
D 3	SLB-26UR3F	L.E.D.	
D 4	—	—	
D 5	SLB-26UR3F	L.E.D.	
D 6	"	"	
D 7	"	"	
D 8	"	"	
	PU49536	Spacer	
R 1	QRD187J-152A	CR	
R 2	" -152A	"	
R 3	" -182A	"	
R 4	" -392A	"	
R 5	" -392A	"	
R 6	" -224A	"	
R 7	" -821A	"	
R 8	" -472A	"	
R 9	" -563A	"	
R10	" -103A	"	
R11	" -103A	"	
R12	" -102A	"	
R13	—	—	
R14	—	—	
R15	QRD142K-821	CR	
R16	" -681	"	
R17	" -821	"	
C 1	QFN31HK-122	MY Cap	
C 2	" -222	"	
C 3	" -122	"	
C 4	" -222	"	
C 5	QCS31HJ-221	C Cap	
C 6	QET61HR-225	E Cap	
C 7	" -225	"	
C 8	" -105	"	
C 9	QET61CR-106	"	
C10	" -336	"	
	PU32571	Shield Cover (1)	Front
	PU49539	" (2)	Rear

9.6.21 TUNER CIRCUIT BOARD ASS'Y $\boxed{4}\boxed{5}$

. . . . . PU49379A (EG)
. . . . . PU49811A (EK)

Symbol No.	Part No.	Part Name	Description
⚠	PU32524	Tuner	EG only
	PU32522	"	EK only
R 1	QRD187J-392A	CR	
R 2	" -392A	"	
R 3	" -392A	"	
R 4	" -392A	"	
C 1	QET61HR-105	E Cap	
C 2	" -474	"	
C 3	QET61ER-106	"	EG only
C 4	" -106	"	
C 5	QET61HR-225	"	
C 6	QFM31HK-124	MY Cap	EG only
	QFN31HK-124	"	EK only
C 7	QFM31HK-124	"	EG only
	QFN31HK-124	"	EK only
C 8	QFM31HK-124	"	EG only
	QFN31HK-124	"	EK only
C 9	QFM31HK-124	"	EG only
	QFN31HK-124	"	EK only

9.6.22 BACK UP CIRCUIT BOARD $\boxed{4}\boxed{6}$

. . . . . PU49930A

Symbol No.	Part No.	Part Name	Description
BATT	PU49933	Battery	
X 1	2SA673C	Transistor	
D 1	RD6.2EB3	Zener Diode	
D 2	1S2473HJ	Diode	
R 1	QRD187J-102	CR	
R 2	" -102	"	
R 3	" -822	"	
R 4	" -103	"	
C 1	QET60JR-107	E Cap	
P 1	PU43351-103	Cap Housing	
TP1	PU45908-3	Test Pin	

SECTION 10
TROUBLESHOOTING GUIDE FOR MECHANISM CONTROL

Before assuming that a fault has developed, please check the following:

Symptoms	Check points
No power is applied to the set.	● Is the power cord disconnected? – Connect it. ● Is the rear panel POWER switch set to OFF? – Set to ON.
Clock is functioning properly, but the set is not powered with the recorder's ON button pressed in.	● Have you switched the power off last via the remote control unit? – If so, press the recorder's OFF button once and then press the recorder's ON button again. – Or simply press the remote control unit's ON button.
Playback picture does not appear while the tape is running.	● Is the TV receiver's channel selector set to the correct video channel? – Set to the RF converter channel. (See page 10.)
REC or AUDIO DUB button cannot be pressed in.	● Is the safety tab on the video cassette broken? – Reseal the slot with cellophane tape.
Tape stops unexpectedly.	● Check the settings of the TAPE MEMORY switches. See pages 27 and 28.
Buttons for variable-speed playback do not function.	● Have you pressed the PLAY button first? – If not, press it.

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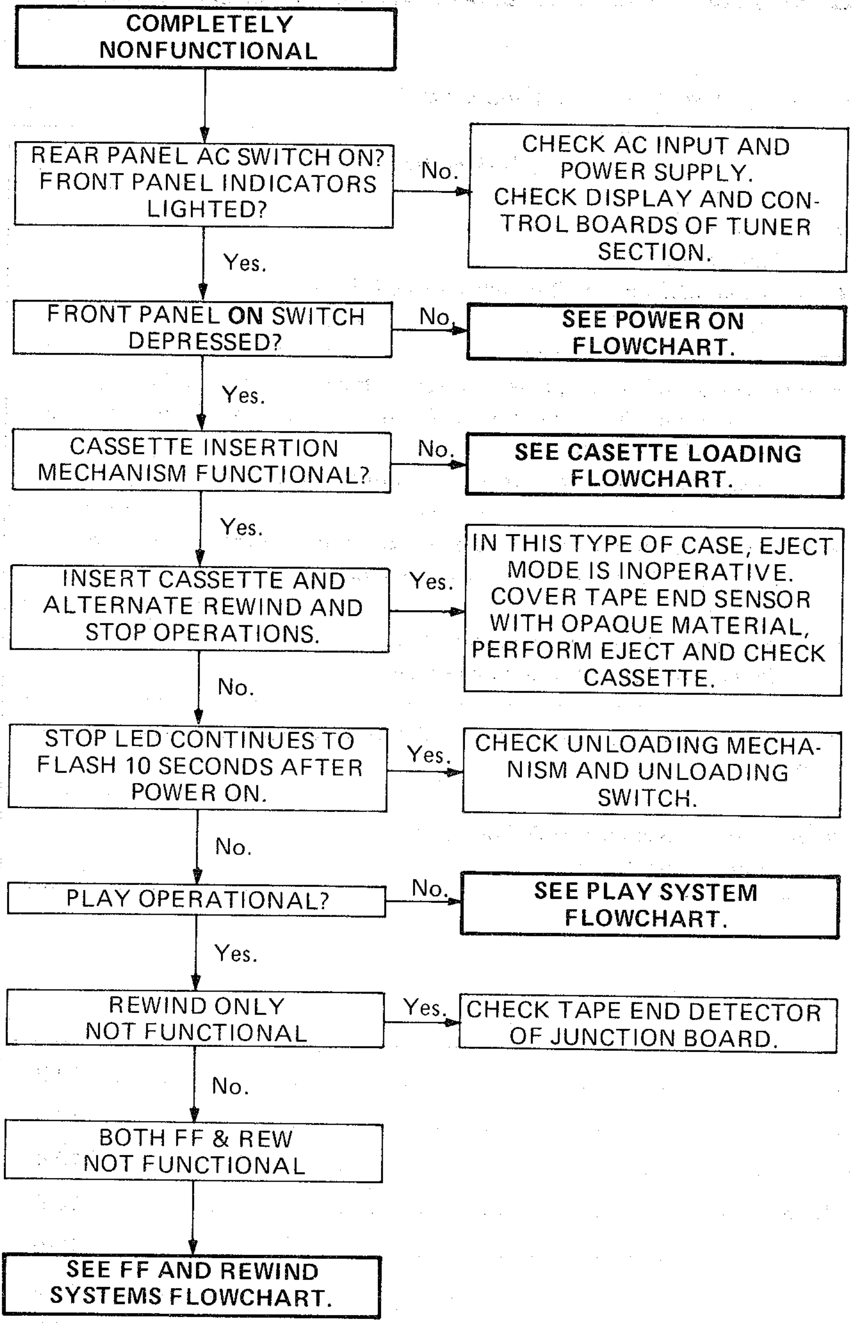
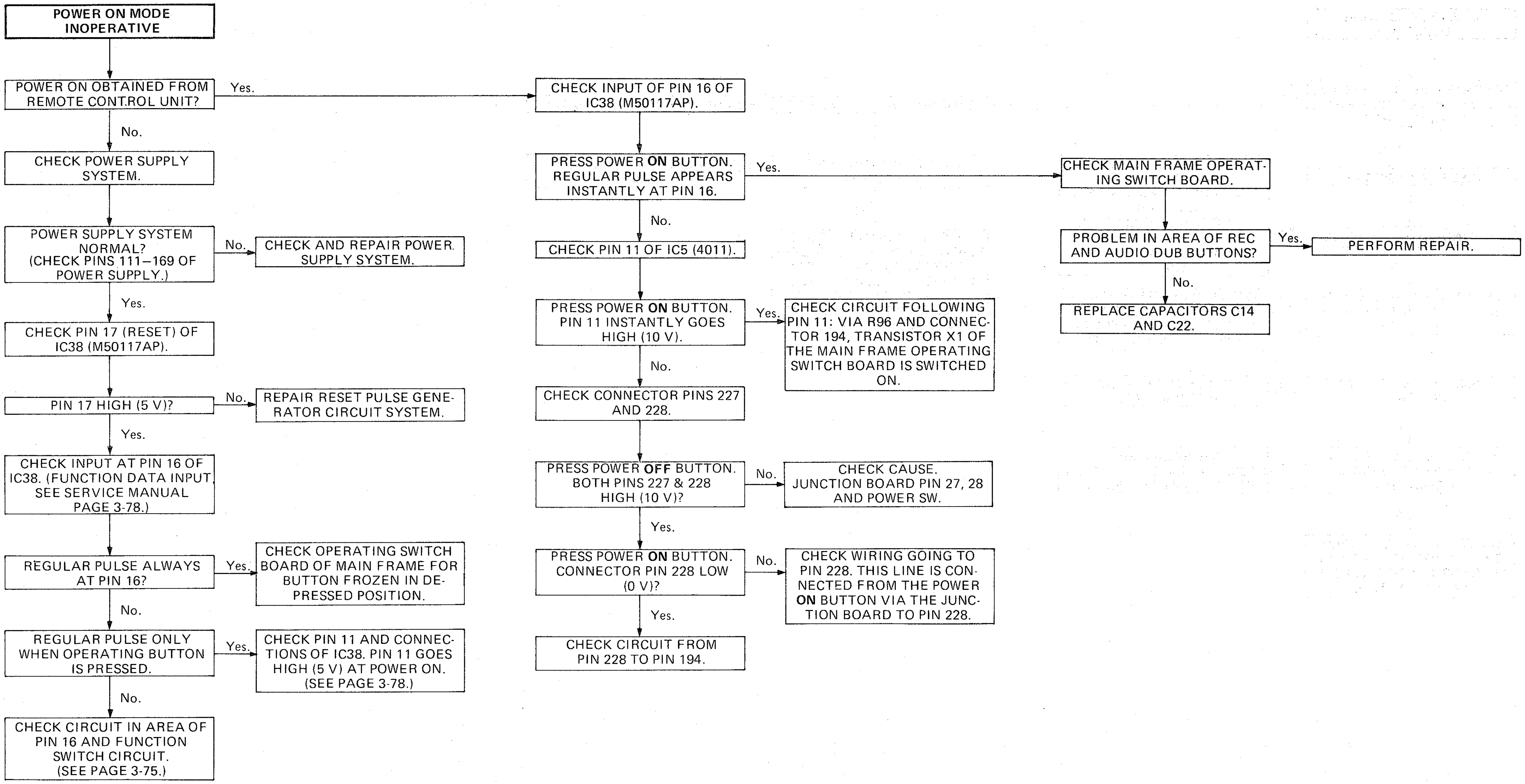
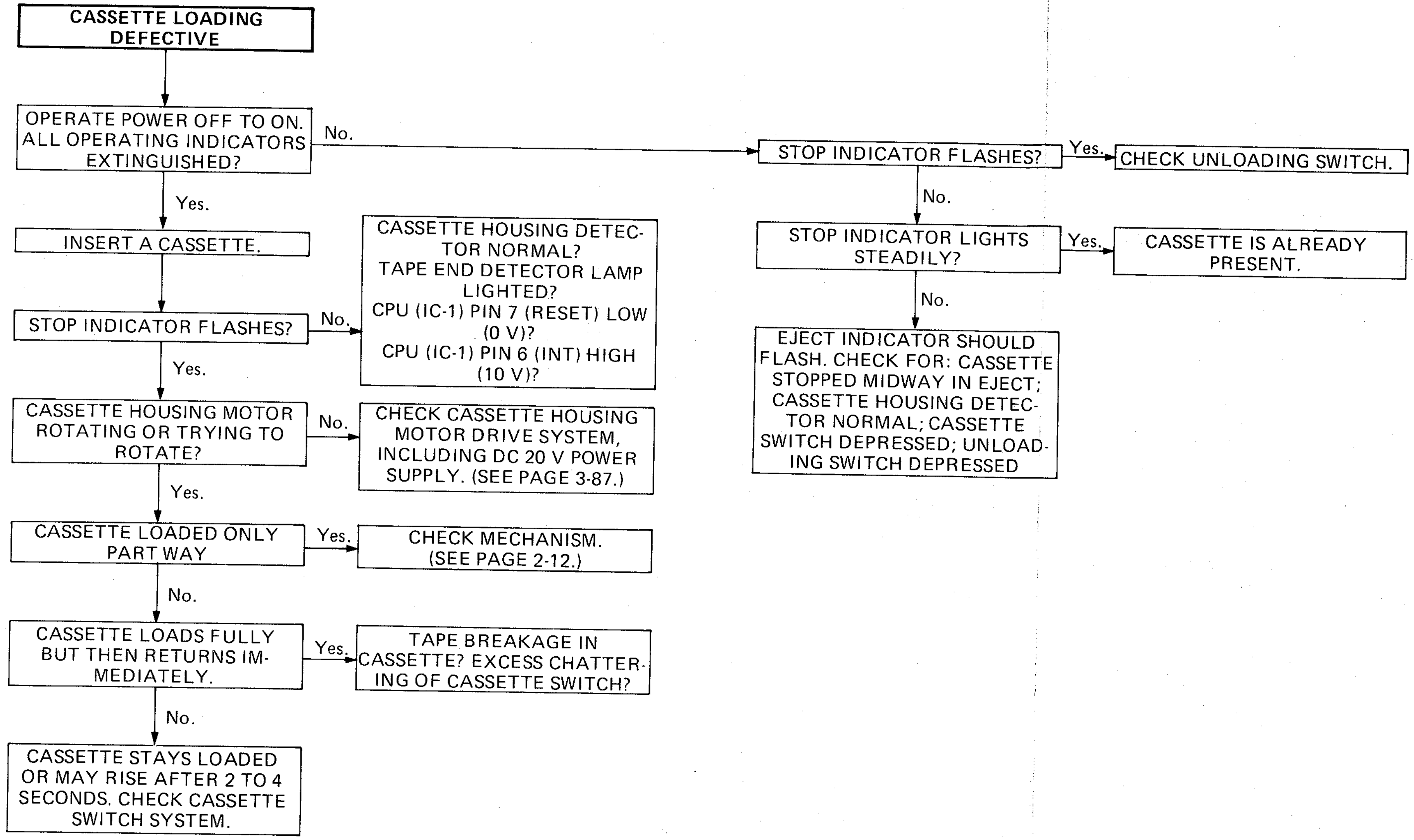
10.1 OVERALL


COMPLETELY NONFUNCTIONAL
REAR PANEL AC SWITCH ON? FRONT PANEL INDICATORS LIGHTED?
No.
CHECK AC INPUT AND POWER SUPPLY. CHECK DISPLAY AND CONTROL BOARDS OF TUNER SECTION.
Yes.
FRONT PANEL ON SWITCH DEPRESSED?
No.
SEE POWER ON FLOWCHART.
Yes.
CASSETTE INSERTION MECHANISM FUNCTIONAL?
No.
SEE CASETTE LOADING FLOWCHART.
Yes.
INSERT CASSETTE AND ALTERNATE REWIND AND STOP OPERATIONS.
Yes.
IN THIS TYPE OF CASE, EJECT MODE IS INOPERATIVE. COVER TAPE END SENSOR WITH OPAQUE MATERIAL, PERFORM EJECT AND CHECK CASSETTE.
No.
STOP LED CONTINUES TO FLASH 10 SECONDS AFTER POWER ON.
Yes.
CHECK UNLOADING MECHANISM AND UNLOADING SWITCH.
No.
PLAY OPERATIONAL?
No.
SEE PLAY SYSTEM FLOWCHART.
Yes.
REWIND ONLY NOT FUNCTIONAL
Yes.
CHECK TAPE END DETECTOR OF JUNCTION BOARD.
No.
BOTH FF & REW NOT FUNCTIONAL
SEE FF AND REWIND SYSTEMS FLOWCHART.

10.2 POWER ON SYSTEM


POWER ON MODE INOPERATIVE
POWER ON OBTAINED FROM REMOTE CONTROL UNIT?
Yes.
No.
CHECK POWER SUPPLY SYSTEM.
POWER SUPPLY SYSTEM NORMAL? (CHECK PINS 111–169 OF POWER SUPPLY.)
No.
CHECK AND REPAIR POWER SUPPLY SYSTEM.
Yes.
CHECK PIN 17 (RESET) OF IC38 (M50117AP).
PIN 17 HIGH (5 V)?
No.
REPAIR RESET PULSE GENERATOR CIRCUIT SYSTEM.
Yes.
CHECK INPUT AT PIN 16 OF IC38. (FUNCTION DATA INPUT, SEE SERVICE MANUAL PAGE 3-78.)
REGULAR PULSE ALWAYS AT PIN 16?
Yes.
CHECK OPERATING SWITCH BOARD OF MAIN FRAME FOR BUTTON FROZEN IN DEPRESSED POSITION.
No.
REGULAR PULSE ONLY WHEN OPERATING BUTTON IS PRESSED.
Yes.
CHECK PIN 11 AND CONNECTIONS OF IC38. PIN 11 GOES HIGH (5 V) AT POWER ON. (SEE PAGE 3-78.)
No.
CHECK CIRCUIT IN AREA OF PIN 16 AND FUNCTION SWITCH CIRCUIT. (SEE PAGE 3-75.)
CHECK INPUT OF PIN 16 OF IC38 (M50117AP).
PRESS POWER ON BUTTON. REGULAR PULSE APPEARS INSTANTLY AT PIN 16.
Yes.
CHECK MAIN FRAME OPERATING SWITCH BOARD.
PROBLEM IN AREA OF REC AND AUDIO DUB BUTTONS?
Yes.
PERFORM REPAIR.
No.
REPLACE CAPACITORS C14 AND C22.
No.
CHECK PIN 11 OF IC5 (4011).
PRESS POWER ON BUTTON. PIN 11 INSTANTLY GOES HIGH (10 V).
Yes.
CHECK CIRCUIT FOLLOWING PIN 11: VIA R96 AND CONNECTOR 194, TRANSISTOR X1 OF THE MAIN FRAME OPERATING SWITCH BOARD IS SWITCHED ON.
No.
CHECK CONNECTOR PINS 227 AND 228.
PRESS POWER OFF BUTTON. BOTH PINS 227 & 228 HIGH (10 V)?
No.
CHECK CAUSE. JUNCTION BOARD PIN 27, 28 AND POWER SW.
Yes.
PRESS POWER ON BUTTON. CONNECTOR PIN 228 LOW (0 V)?
No.
CHECK WIRING GOING TO PIN 228. THIS LINE IS CONNECTED FROM THE POWER ON BUTTON VIA THE JUNCTION BOARD TO PIN 228.
Yes.
CHECK CIRCUIT FROM PIN 228 TO PIN 194.

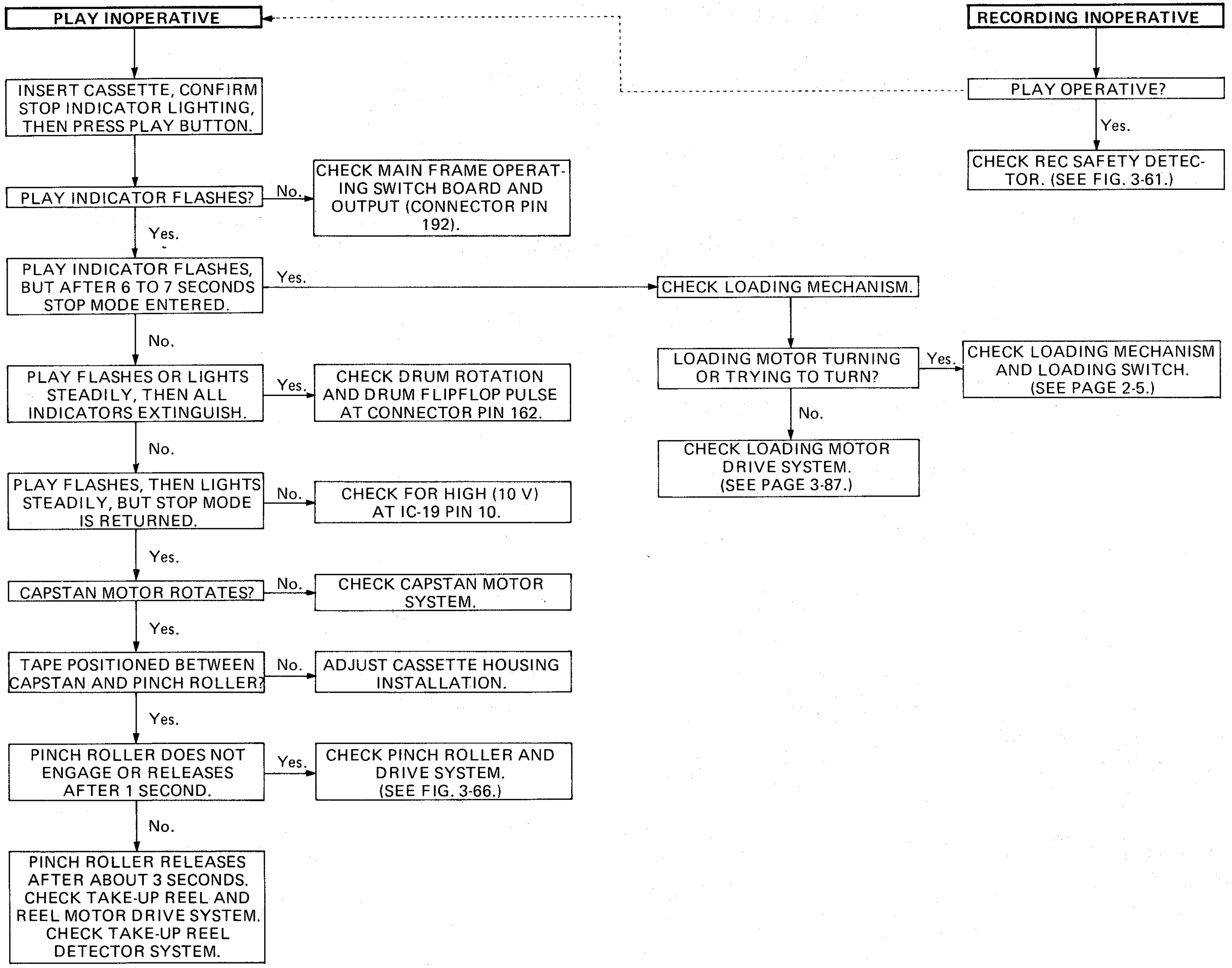
10.3 CASSETTE LOADING SYSTEM


CASSETTE LOADING DEFECTIVE
OPERATE POWER OFF TO ON. ALL OPERATING INDICATORS EXTINGUISHED?
No.
STOP INDICATOR FLASHES?
Yes.
CHECK UNLOADING SWITCH.
No.
STOP INDICATOR LIGHTS STEADILY?
Yes.
CASSETTE IS ALREADY PRESENT.
No.
EJECT INDICATOR SHOULD FLASH. CHECK FOR: CASSETTE STOPPED MIDWAY IN EJECT; CASSETTE HOUSING DETECTOR NORMAL; CASSETTE SWITCH DEPRESSED; UNLOADING SWITCH DEPRESSED
Yes.
INSERT A CASSETTE.
STOP INDICATOR FLASHES?
No.
CASSETTE HOUSING DETECTOR NORMAL? TAPE END DETECTOR LAMP LIGHTED? CPU (IC-1) PIN 7 (RESET) LOW (0 V)? CPU (IC-1) PIN 6 (INT) HIGH (10 V)?
Yes.
CASSETTE HOUSING MOTOR ROTATING OR TRYING TO ROTATE?
No.
CHECK CASSETTE HOUSING MOTOR DRIVE SYSTEM, INCLUDING DC 20 V POWER SUPPLY. (SEE PAGE 3-87.)
Yes.
CASSETTE LOADED ONLY PART WAY
Yes.
CHECK MECHANISM. (SEE PAGE 2-12.)
No.
CASSETTE LOADS FULLY BUT THEN RETURNS IMMEDIATELY.
Yes.
TAPE BREAKAGE IN CASSETTE? EXCESS CHATTERING OF CASSETTE SWITCH?
No.
CASSETTE STAYS LOADED OR MAY RISE AFTER 2 TO 4 SECONDS. CHECK CASSETTE SWITCH SYSTEM.

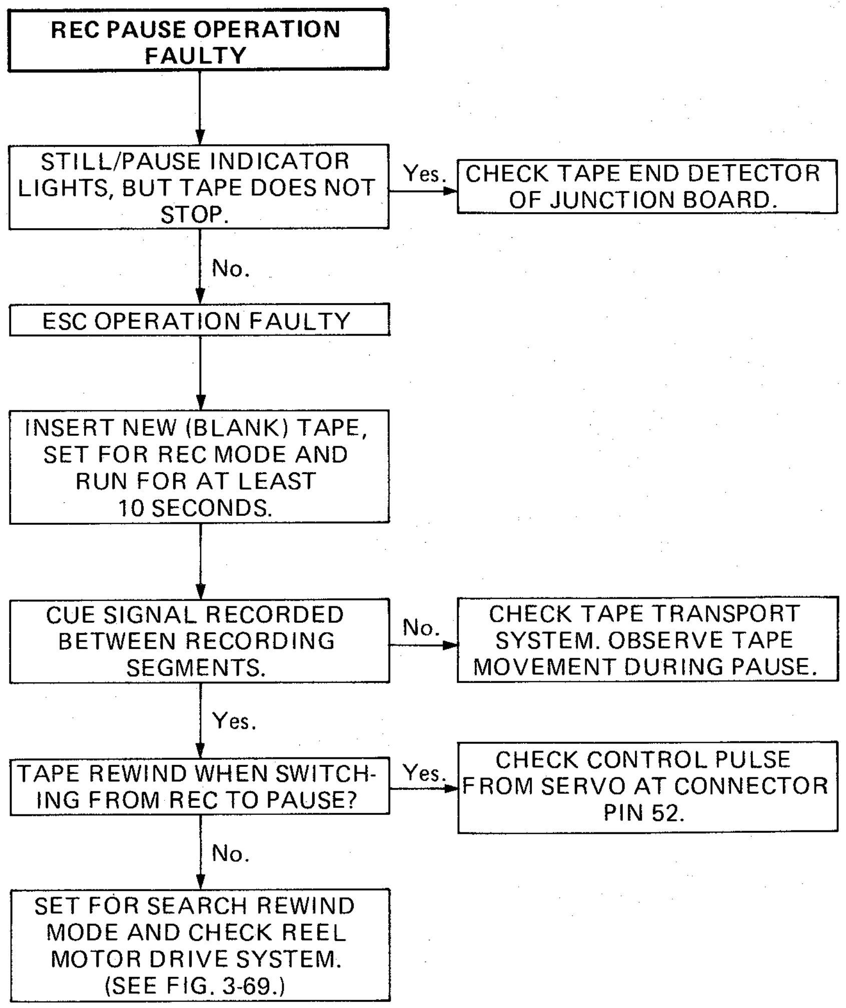
10.4 PLAY AND RECORDING SYSTEMS

10.4.1 Play system

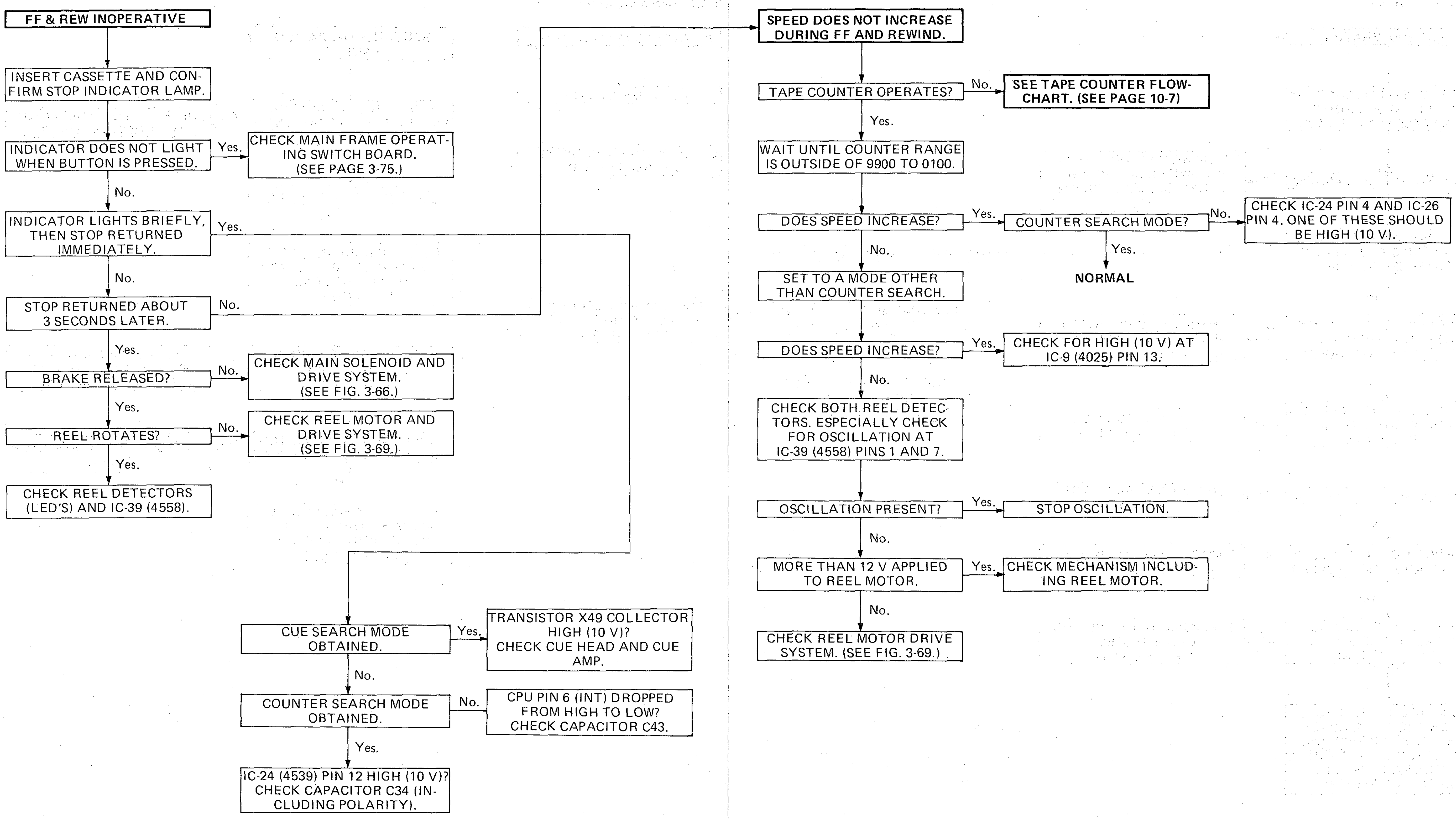
10.4.2 Recording system


PLAY INOPERATIVE
INSERT CASSETTE, CONFIRM STOP INDICATOR LIGHTING, THEN PRESS PLAY BUTTON.
PLAY INDICATOR FLASHES?
No.
CHECK MAIN FRAME OPERATING SWITCH BOARD AND OUTPUT (CONNECTOR PIN 192).
Yes.
PLAY INDICATOR FLASHES, BUT AFTER 6 TO 7 SECONDS STOP MODE ENTERED.
Yes.
CHECK LOADING MECHANISM.
LOADING MOTOR TURNING OR TRYING TO TURN?
Yes.
CHECK LOADING MECHANISM AND LOADING SWITCH. (SEE PAGE 2-5.)
No.
CHECK LOADING MOTOR DRIVE SYSTEM. (SEE PAGE 3-87.)
No.
PLAY FLASHES OR LIGHTS STEADILY, THEN ALL INDICATORS EXTINGUISH.
Yes.
CHECK DRUM ROTATION AND DRUM FLIPFLOP PULSE AT CONNECTOR PIN 162.
No.
PLAY FLASHES, THEN LIGHTS STEADILY, BUT STOP MODE IS RETURNED.
No.
CHECK FOR HIGH (10 V) AT IC-19 PIN 10.
Yes.
CAPSTAN MOTOR ROTATES?
No.
CHECK CAPSTAN MOTOR SYSTEM.
Yes.
TAPE POSITIONED BETWEEN CAPSTAN AND PINCH ROLLER?
No.
ADJUST CASSETTE HOUSING INSTALLATION.
Yes.
PINCH ROLLER DOES NOT ENGAGE OR RELEASES AFTER 1 SECOND.
Yes.
CHECK PINCH ROLLER AND DRIVE SYSTEM. (SEE FIG. 3-66.)
No.
PINCH ROLLER RELEASES AFTER ABOUT 3 SECONDS. CHECK TAKE-UP REEL AND REEL MOTOR DRIVE SYSTEM. CHECK TAKE-UP REEL DETECTOR SYSTEM.
RECORDING INOPERATIVE
PLAY OPERATIVE?
Yes.
CHECK REC SAFETY DETECTOR. (SEE FIG. 3-61.)

10.4.3 REC PAUSE system

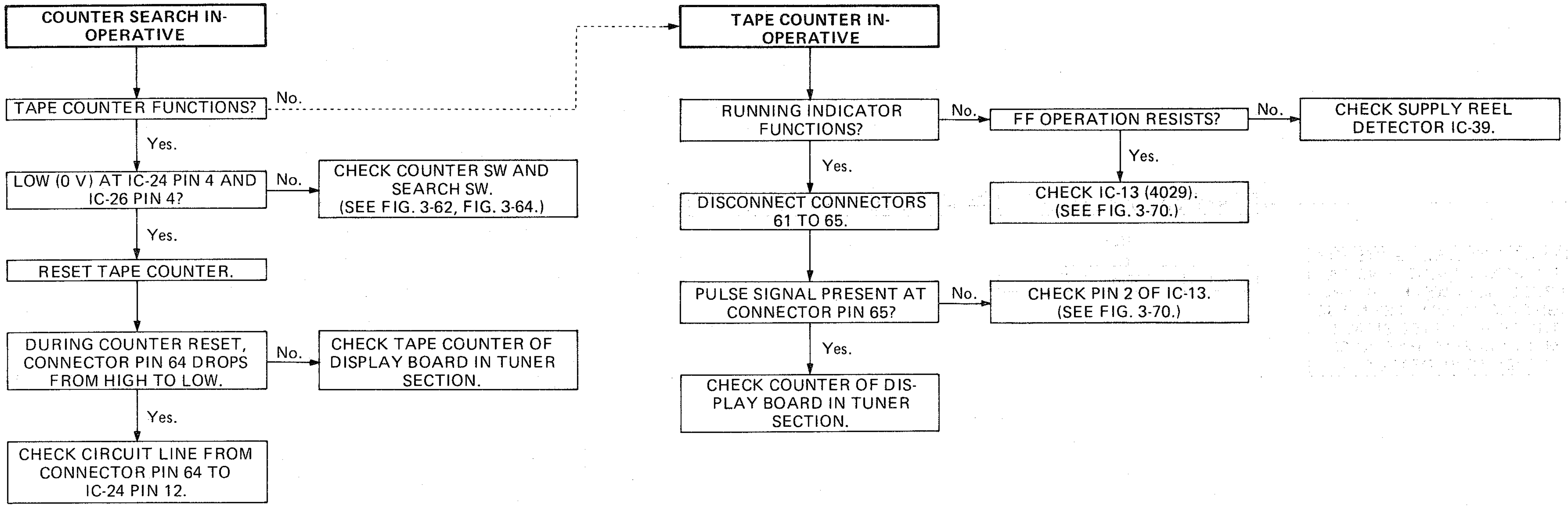

REC PAUSE OPERATION FAULTY
STILL/PAUSE INDICATOR LIGHTS, BUT TAPE DOES NOT STOP.
Yes.
CHECK TAPE END DETECTOR OF JUNCTION BOARD.
No.
ESC OPERATION FAULTY
INSERT NEW (BLANK) TAPE, SET FOR REC MODE AND RUN FOR AT LEAST 10 SECONDS.
CUE SIGNAL RECORDED BETWEEN RECORDING SEGMENTS.
No.
CHECK TAPE TRANSPORT SYSTEM. OBSERVE TAPE MOVEMENT DURING PAUSE.
Yes.
TAPE REWIND WHEN SWITCHING FROM REC TO PAUSE?
Yes.
CHECK CONTROL PULSE FROM SERVO AT CONNECTOR PIN 52.
No.
SET FOR SEARCH REWIND MODE AND CHECK REEL MOTOR DRIVE SYSTEM. (SEE FIG. 3-69.)

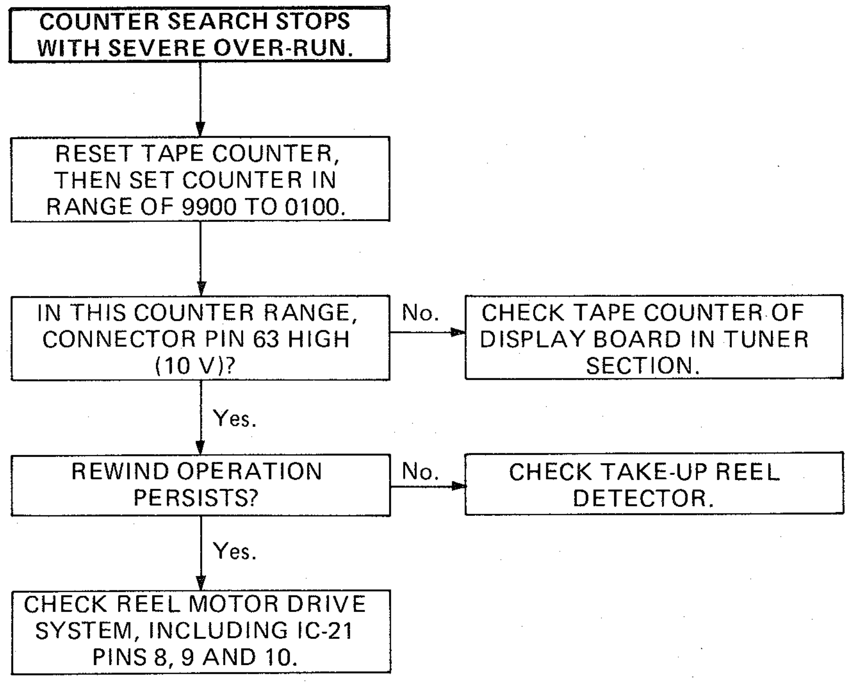
10.5 FF AND REWIND SYSTEMS


FF & REW INOPERATIVE
INSERT CASSETTE AND CONFIRM STOP INDICATOR LAMP.
INDICATOR DOES NOT LIGHT WHEN BUTTON IS PRESSED.
Yes.
CHECK MAIN FRAME OPERATING SWITCH BOARD. (SEE PAGE 3-75.)
No.
INDICATOR LIGHTS BRIEFLY, THEN STOP RETURNED IMMEDIATELY.
Yes.
No.
STOP RETURNED ABOUT 3 SECONDS LATER.
No.
Yes.
BRAKE RELEASED?
No.
CHECK MAIN SOLENOID AND DRIVE SYSTEM. (SEE FIG. 3-66.)
Yes.
REEL ROTATES?
No.
CHECK REEL MOTOR AND DRIVE SYSTEM. (SEE FIG. 3-69.)
Yes.
CHECK REEL DETECTORS (LED'S) AND IC-39 (4558).
CUE SEARCH MODE OBTAINED.
Yes.
TRANSISTOR X49 COLLECTOR HIGH (10 V)? CHECK CUE HEAD AND CUE AMP.
No.
COUNTER SEARCH MODE OBTAINED.
No.
CPU PIN 6 (INT) DROPPED FROM HIGH TO LOW? CHECK CAPACITOR C43.
Yes.
IC-24 (4539) PIN 12 HIGH (10 V)? CHECK CAPACITOR C34 (INCLUDING POLARITY).
SPEED DOES NOT INCREASE DURING FF AND REWIND.
TAPE COUNTER OPERATES?
No.
SEE TAPE COUNTER FLOWCHART. (SEE PAGE 10-7)
Yes.
WAIT UNTIL COUNTER RANGE IS OUTSIDE OF 9900 TO 0100.
DOES SPEED INCREASE?
Yes.
COUNTER SEARCH MODE?
No.
CHECK IC-24 PIN 4 AND IC-26 PIN 4. ONE OF THESE SHOULD BE HIGH (10 V).
Yes.
NORMAL
No.
SET TO A MODE OTHER THAN COUNTER SEARCH.
DOES SPEED INCREASE?
Yes.
CHECK FOR HIGH (10 V) AT IC-9 (4025) PIN 13.
No.
CHECK BOTH REEL DETECTORS. ESPECIALLY CHECK FOR OSCILLATION AT IC-39 (4558) PINS 1 AND 7.
OSCILLATION PRESENT?
Yes.
STOP OSCILLATION.
No.
MORE THAN 12 V APPLIED TO REEL MOTOR.
Yes.
CHECK MECHANISM INCLUDING REEL MOTOR.
No.
CHECK REEL MOTOR DRIVE SYSTEM. (SEE FIG. 3-69.)

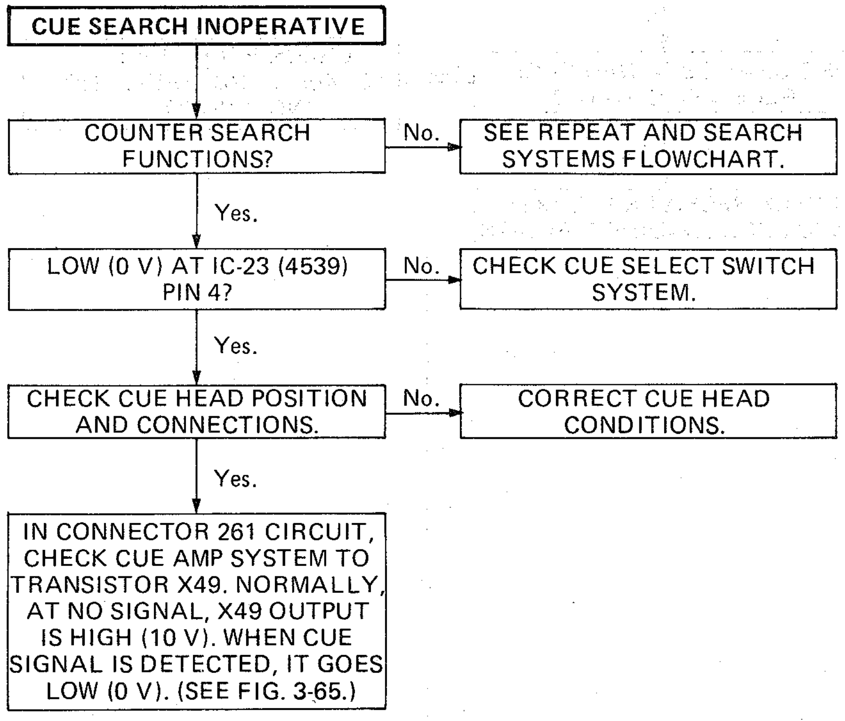
10.6 REPEAT AND SEARCH SYSTEMS

10.6.1 Counter search system

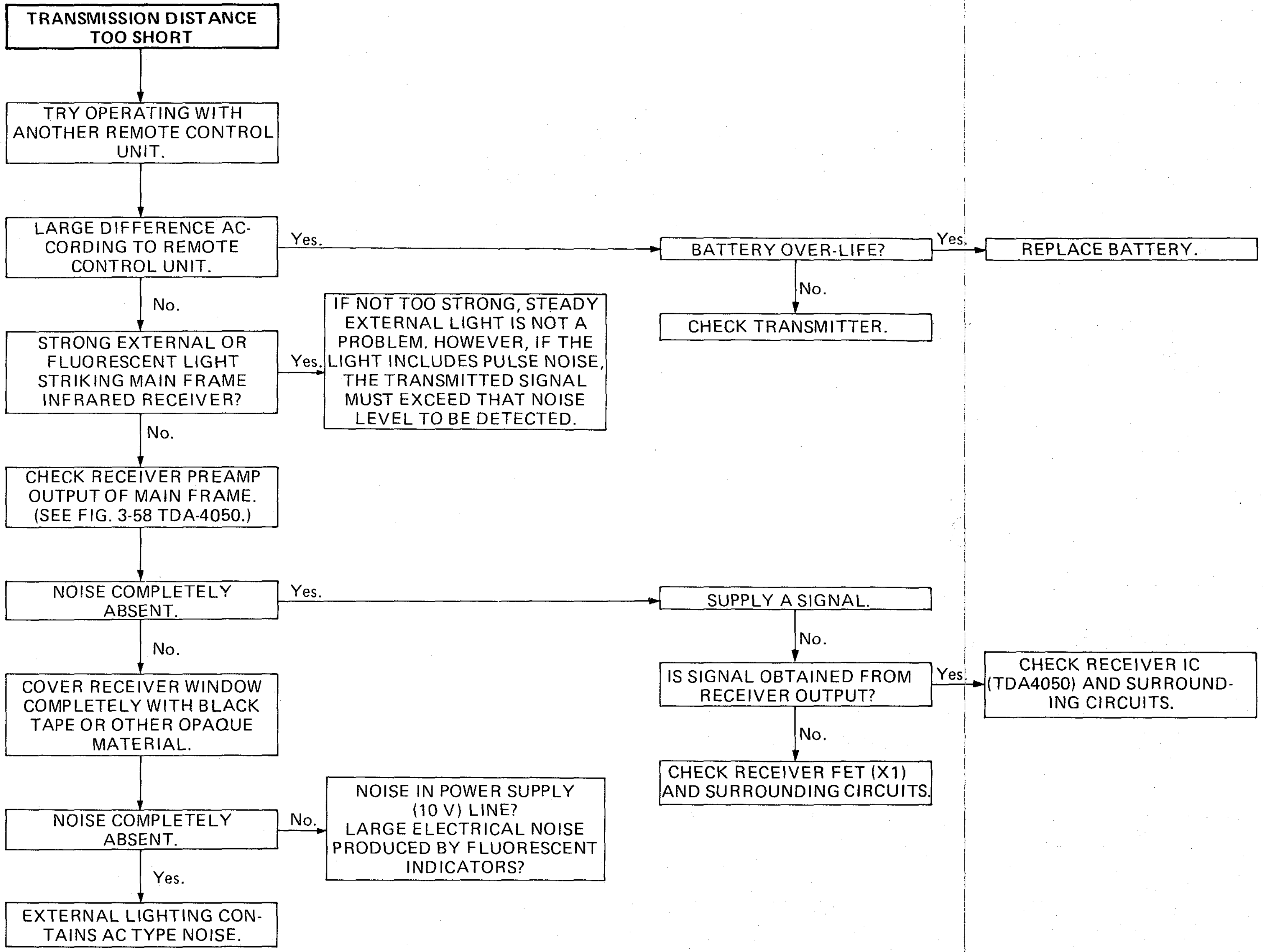

COUNTER SEARCH INOPERATIVE
TAPE COUNTER FUNCTIONS?
No.
Yes.
LOW (0 V) AT IC-24 PIN 4 AND IC-26 PIN 4?
No.
CHECK COUNTER SW AND SEARCH SW. (SEE FIG. 3-62, FIG. 3-64.)
Yes.
RESET TAPE COUNTER.
DURING COUNTER RESET, CONNECTOR PIN 64 DROPS FROM HIGH TO LOW.
No.
CHECK TAPE COUNTER OF DISPLAY BOARD IN TUNER SECTION.
Yes.
CHECK CIRCUIT LINE FROM CONNECTOR PIN 64 TO IC-24 PIN 12.
TAPE COUNTER INOPERATIVE
RUNNING INDICATOR FUNCTIONS?
No.
FF OPERATION RESISTS?
No.
CHECK SUPPLY REEL DETECTOR IC-39.
Yes.
CHECK IC-13 (4029). (SEE FIG. 3-70.)
Yes.
DISCONNECT CONNECTORS 61 TO 65.
PULSE SIGNAL PRESENT AT CONNECTOR PIN 65?
No.
CHECK PIN 2 OF IC-13. (SEE FIG. 3-70.)
Yes.
CHECK COUNTER OF DISPLAY BOARD IN TUNER SECTION.


COUNTER SEARCH STOPS WITH SEVERE OVER-RUN.
RESET TAPE COUNTER, THEN SET COUNTER IN RANGE OF 9900 TO 0100.
IN THIS COUNTER RANGE, CONNECTOR PIN 63 HIGH (10 V)?
No.
CHECK TAPE COUNTER OF DISPLAY BOARD IN TUNER SECTION.
Yes.
REWIND OPERATION PERSISTS?
No.
CHECK TAKE-UP REEL DETECTOR.
Yes.
CHECK REEL MOTOR DRIVE SYSTEM, INCLUDING IC-21 PINS 8, 9 AND 10.

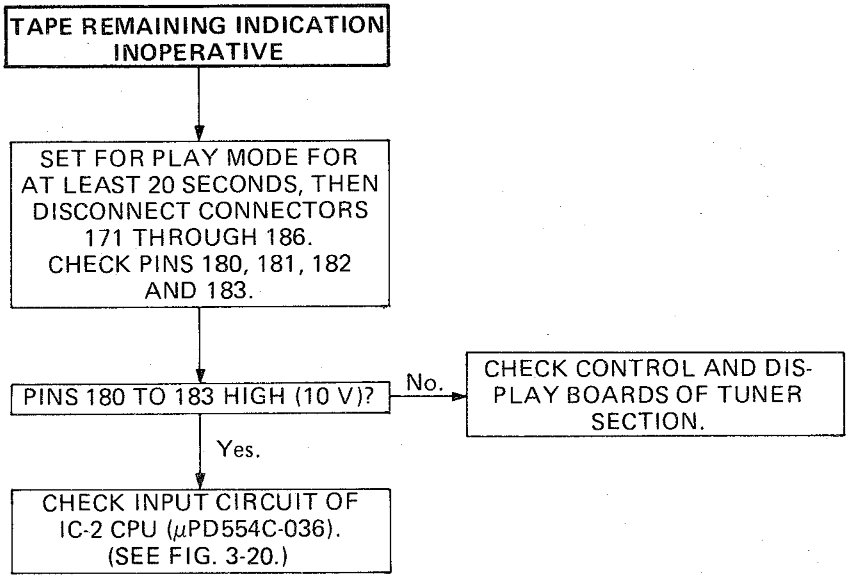
10.6.2 Cue search system

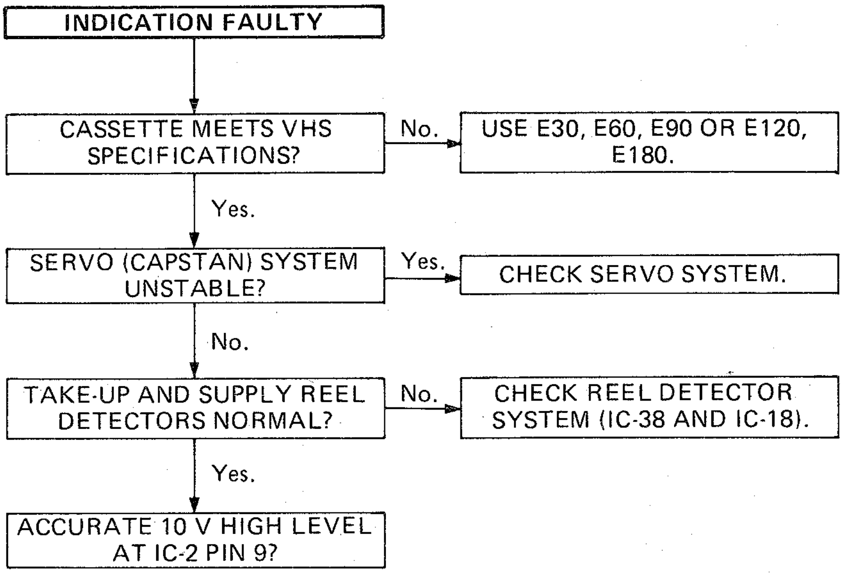

CUE SEARCH INOPERATIVE
COUNTER SEARCH FUNCTIONS?
No.
SEE REPEAT AND SEARCH SYSTEMS FLOWCHART.
Yes.
LOW (0 V) AT IC-23 (4539) PIN 4?
No.
CHECK CUE SELECT SWITCH SYSTEM.
Yes.
CHECK CUE HEAD POSITION AND CONNECTIONS.
No.
CORRECT CUE HEAD CONDITIONS.
Yes.
IN CONNECTOR 261 CIRCUIT, CHECK CUE AMP SYSTEM TO TRANSISTOR X49. NORMALLY, AT NO SIGNAL, X49 OUTPUT IS HIGH (10 V). WHEN CUE SIGNAL IS DETECTED, IT GOES LOW (0 V). (SEE FIG. 3-65.)

10.7 REMOTE CONTROL UNIT


TRANSMISSION DISTANCE TOO SHORT
TRY OPERATING WITH ANOTHER REMOTE CONTROL UNIT.
LARGE DIFFERENCE ACCORDING TO REMOTE CONTROL UNIT.
Yes.
BATTERY OVER-LIFE?
Yes.
REPLACE BATTERY.
No.
CHECK TRANSMITTER.
No.
STRONG EXTERNAL OR FLUORESCENT LIGHT STRIKING MAIN FRAME INFRARED RECEIVER?
Yes.
IF NOT TOO STRONG, STEADY EXTERNAL LIGHT IS NOT A PROBLEM. HOWEVER, IF THE LIGHT INCLUDES PULSE NOISE, THE TRANSMITTED SIGNAL MUST EXCEED THAT NOISE LEVEL TO BE DETECTED.
No.
CHECK RECEIVER PREAMP OUTPUT OF MAIN FRAME. (SEE FIG. 3-58 TDA-4050.)
NOISE COMPLETELY ABSENT.
Yes.
SUPPLY A SIGNAL.
No.
IS SIGNAL OBTAINED FROM RECEIVER OUTPUT?
Yes.
CHECK RECEIVER IC (TDA4050) AND SURROUNDING CIRCUITS.
No.
CHECK RECEIVER FET (X1) AND SURROUNDING CIRCUITS.
No.
COVER RECEIVER WINDOW COMPLETELY WITH BLACK TAPE OR OTHER OPAQUE MATERIAL.
NOISE COMPLETELY ABSENT.
No.
NOISE IN POWER SUPPLY (10 V) LINE? LARGE ELECTRICAL NOISE PRODUCED BY FLUORESCENT INDICATORS?
Yes.
EXTERNAL LIGHTING CONTAINS AC TYPE NOISE.

10.8 TAPE REMAINING INDICATOR


TAPE REMAINING INDICATION INOPERATIVE
SET FOR PLAY MODE FOR AT LEAST 20 SECONDS, THEN DISCONNECT CONNECTORS 171 THROUGH 186. CHECK PINS 180, 181, 182 AND 183.
PINS 180 TO 183 HIGH (10 V)?
No.
CHECK CONTROL AND DISPLAY BOARDS OF TUNER SECTION.
Yes.
CHECK INPUT CIRCUIT OF IC-2 CPU (μPD554C-036). (SEE FIG. 3-20.)


INDICATION FAULTY
CASSETTE MEETS VHS SPECIFICATIONS?
No.
USE E30, E60, E90 OR E120, E180.
Yes.
SERVO (CAPSTAN) SYSTEM UNSTABLE?
Yes.
CHECK SERVO SYSTEM.
No.
TAKE-UP AND SUPPLY REEL DETECTORS NORMAL?
No.
CHECK REEL DETECTOR SYSTEM (IC-38 AND IC-18).
Yes.
ACCURATE 10 V HIGH LEVEL AT IC-2 PIN 9?